Comparing Graduate Courses Taught By The Same Instructor Using Competing Approaches: Traditional Vs. Technology-Infused

by

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ABSTRACT

The use of educational technologies as a tool to improve academic achievement continues to increase as more technologies becomes available to students. However, teachers are entering the classroom not fully prepared to integrate technology into their daily classroom teaching because they have not been adequately prepared to do so. Teacher preparation programs are falling short in this area because educational technology and the role of technology in the classroom is seen as an extra component to daily teaching rather than a central one. Many teacher preparation programs consist of one stand-alone educational technology course that is expected to prepare teachers to integrate technology in their future classrooms. Throughout the remainder of the program, the teachers are not seeing educational technologies modeled in their other core courses, nor are they getting the hands-on interaction necessary to become more confident in using these technologies with their future students.

The purpose of this study was to examine teachers' views of educational technology in the classroom from those enrolled in a graduate program. The study consisted 74 first- and second-year teachers who were enrolled an alternative teacher preparation program. Thirty-four of the teachers received the Integrating Curriculum and Technology (iCAT) intervention and the remaining 40 teachers were part of the control group. Each teacher completed a pre- and post-intervention questionnaire and 23 of the 74 teachers participated in one of three focus group interviews. Additional data from the teachers' course instructors were gathered and analyzed to compliment the focus group and quantitative data.

Results showed that iCAT participants' scores for confidence in using technology and efficacy for using educational technology increased at a faster rate than the control group participants' scores. Similarly, confidence in using technology, perceptions about integrating technology in the classroom, and efficacy for using educational technology could be predicted by the amount of hands-on interaction with technology that the teachers received during their graduate course.

The discussion focuses on recommendations for infusing technology throughout teacher preparation programs so that teachers have the tools to prepare their students to use a variety of technologies so that their students can be better prepared to complete in today's workforce.

DEDICATION

Erin.

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INTRODUCTION

> Technology is and will continue to be an integral part of classrooms, workplaces, and our everyday life. Using technology helps early learners to communicate, practice life skills, and better understand concepts. If used pragmatically, students will be better equipped to begin using 21st century tools independently as they enter elementary schools. (Hubble, 2007, p. 35)

In most teacher preparation programs, students complete a stand-alone educational technology course as part of their requirements for earning their teaching credentials (Brown & Warschauer, 2006; Lambert & Gong, 2010). Beyond this one course, students are typically neither seeing educational technologies modeled into their other core courses, nor are they getting the hands-on interaction necessary to become more confident in using these technologies with their future students (Brown & Warschauer, 2006; Lambert & Gong, 2010).

Although using the stand-alone course predominates at most institutions (Kleiner, Thomas, & Lewis, 2007), certain programs do not have sufficient credit hours to allow for such a stand-alone course in the program. Such is the case with the Induction with Masters and Certification (InMAC) graduate program at a large urban university in the southwest United States. As an instructor in the InMAC program, I have noticed that candidates, who are coming into the program with degrees outside of education, are completing a graduate program in which they are receiving little exposure to the variety of educational technologies that can be used to enhance their classroom teaching. Data from a pilot study confirmed that Microsoft Office™ tools and the Internet are the two primary technologies observed by candidates throughout the program (Kisicki, Buss, & Wetzel, 2010). Of the three degrees offered within the InMAC program, only candidates in the Masters in Elementary Education program receive a stand-alone educational technology course. The other two programs, Masters in Secondary Education and Masters in Special Education, do not have a stand-alone educational technology course. This means that exposing candidates to educational technologies is left to the instructors to implement into their courses. Results from the pilot study showed that very few technologies were in fact implemented into these courses.

To help prepare the course instructors to implement various technologies into their courses, I designed a program that provided instructors with a professional development experience that helped them become comfortable using various educational technologies and implementing those same technologies using proven successful pedagogical strategies. The purpose of this study was to examine Masters level candidates' views of educational technology in the classroom from those enrolled in a graduate program and their instructors at a large urban university in the southwest United States.

Definition of Terms

I am including a section of terms that are used throughout this, and other chapters. This section will help the readers understand the terms by providing a definition for how each of these terms is used throughout this study.

Attitudes: Indicates the candidates' way of thinking about educational technology.

Cohort: A group of students who follow the same course path from the start of the InMAC program through its completion.

Community of Practice: Communities of practice are formed by people who engage in a process of collective learning in a shared domain of human endeavor.

Educational technologies: A variety of technologies can be used to enhance teaching and learning experiences. For this study, examples include classroom response systems, iPads, Podcasts, and screencasts.

Educational technology specialist: A person who helps integrate technologies, such as computers, hardware and software, into educational settings. For this study, the researcher served as the educational technology specialist.

iCAT Program: The students in the Integrating Content and Technology (iCAT) program will receive the intervention treatment for this study.

Hybrid course: An eight-week course that blends face-to-face interaction such as in-class discussions, group work, and live lectures with work to be completed outside of regularly scheduled class time.

In-service teachers: For this study, in-service teachers are students who are actively teaching in a K-12 classroom and are considered the teacher-of-record.

InMAC: The Induction, Master of Education and [State] Certification (InMAC) is an alternative teacher certification and graduate program in the state where the research is being conducted.

NCLB: The No Child Left Behind (NCLB) act is a standards-based educational reform concerning the education of children in U.S. public schools.

Non-traditional student: The participants in this study are considered non-traditional because they are completing a Masters in Education with no previous teaching experience.

One-on-one coaching: This is a professional development approach in which the educational technology specialist works one-on-one with InMAC instructors to infuse technology throughout their course assignments and activities.

Pedagogical strategies: Proven instructional strategies for integrating technology into the classroom.

PT3: Preparing Tomorrow's Teachers to Use Technology (PT3) is a U.S. Department of Education grant-funded program designed to help teachers become more comfortable using technology in their teaching.

Self-efficacy: Bandura's definition is "The belief in one's capabilities to organize and execute the courses of action required to manage prospective situations" (1995, p. 2).

Screencasts: A screen capture of the actions on a user's computer screen.

Stand-alone technology course: A course that candidates complete to improve technology proficiency and the integration of technology in their classrooms, but that is separate from the rest of their coursework. An alternative is a methods course in which technology is infused throughout the course assignments and activities.

Technology-infused course: An academic content or methods course that integrates the use of technology throughout course assignments and activities.

TPACK: Technological Pedagogical and Content Knowledge (TPACK) is the theoretical framework used for this study developed by Koehler and Mishra at Michigan State University. TPACK builds on Shulman's idea of Pedagogical Content Knowledge.

Treatment group: The students who receive the iCAT intervention.

Utilization: The participants' level of technology integration in their classroom activities.

WIFI: Wireless Internet connection.

Overview of the Problem

The use of computers and the Internet as a tool to improve academic achievement has been endorsed by a number of state and federal agencies over the past two decades (See International Society for Technology in Education [ISTE], 2002). Nevertheless, traditional teacher preparation programs have not adequately provided teachers with sufficient modeling and hands-on interaction for technology integration (Brown & Warschauer, 2006; Carlson & Gooden, 1999; Smerdon et al., 2000). Further, both preservice and in-service teachers are seeing educational technology and the role of technology in the classroom as a *peripheral* component to their daily teaching (Brown & Warschauer, 2006; Lambert & Gong, 2010) rather than a central one.

Since 1999, Preparing Tomorrow's Teachers to use Technology (PT3) and other programs were developed to address these concerns by using a variety of methods to help future teachers use technology to increase the effectiveness of teaching and learning (Brown & Warschauer, 2006). Aside from a small number of reported successes, teacher preparation programs are still falling short in the area of educational technology (Rowley, Dysand, & Arnold, 2005; Waddoups, Lambert & Gong, 2010; Wentworth & Earle, 2004) because technology is seen as unimportant in the program and students are observing little technology integration in their methods courses and placement observations (Brown & Warschauer, 2006).

Although improving the integration of technology in K-12 instruction has become increasingly important in the US, a key factor hindering the effective use of technology integration is the limited experiences (Howley & Howley, 2008; PT3, 2002) of computer use in both teacher preparation programs and K-12 professional development.

Purpose of the Study

The purpose of this concurrent mixed methods study was to examine Masters level candidates' views of educational technology in the classroom from those enrolled in a graduate program and their instructors at a large urban university in the southwest United States. A professional development program was developed and implemented to increase the instances of technology integration into these graduate courses. Entitled *Integrating Content and Technology* or iCAT, the professional development program provided learning opportunities on a variety of educational technologies. There were seven cohorts of students–four cohorts that served as the treatment group and received the iCAT intervention and three cohorts that served as the control group and did not receive the iCAT intervention. In the study, a questionnaire, designed by the researcher, was used to measure the exposure to various educational technologies during a graduate teacher preparation course and teachers' self-efficacy, attitudes, and utilization of educational technology in the classroom. At the same time, the researcher conducted focus group interviews and collected additional artifacts such as instructor reflection logs and informal observation notes to explore candidates' views of using educational technology in the classroom. A pre-intervention questionnaire was administered to both control and treatment groups at the beginning of the spring 2012 semester. The instructor reflection logs were submitted to the researcher on a weekly basis. The remaining data sources were collected near the end of each course during the spring 2012 semester. The reason for combining both quantitative and qualitative data is to better understand this research problem by examining both of the data sources and then determining whether there is converging evidence from the quantitative and qualitative data (Creswell, 2007), allowing for a complementary analysis.

Justification for the Study

In addition to adding to the research base on this topic, the goal of this study was to help school officials make decisions regarding the effective planning and implementation of technology integration into university course curriculum. Moreover, because I am studying novice teachers, the findings of this study may also help influence the decisions of those in similar settings. The results from this study may be helpful in developing a larger scale study to determine effective ways to provide professional development for the integration of technology.

Research Questions

The following research questions guided this study:

How and to what extent were there differences in confidence, self-efficacy, attitude, and utilization of educational technology for in-service teachers who:

a. completed two, three-credit hour graduate courses where educational technologies were integrated throughout both courses versus those who completed two, three-credit hour graduate courses where educational technologies were not integrated throughout both courses; and
b. completed two, three-credit hour graduate courses and had already completed a stand-alone educational technology course (EED 531–Teaching with Educational Technology) during their graduate program?

Additionally, the study explored how and to what extent confidence, self-efficacy, attitude, and utilization of educational technology were predicted from modeling and hands-on exposure that in-service teachers (candidates) experienced during a graduate course(s)?

Limitations of the Study

The participants were in-service teachers (candidates) who were in the first semester of either their first or second year and who had completed a six-week course in the foundations of education prior to starting their first teaching assignment. Therefore, the results may not be generalized to students who completed a traditional teacher preparation program.

Organization of Chapters

This dissertation is divided into five major chapters. Included in Chapter 1 is an introduction, overview of the problem, a purpose for the study, research questions pertaining to the study, operational definitions for key words used throughout the dissertation, purpose of the study, justification for the study, and limitations of the study. Chapter 2 includes a review of the literature pertinent teacher self-efficacy, professional development, the integration of technology into the classroom, and the theoretical framework that guided the study. Chapter 3 incorporates the methodology used for this dissertation including a description of the participants, the instruments used to collect data, the procedures the researcher followed, and data analysis procedures. Chapter 4 includes results from the quantitative and qualitative data collected during the dissertation study. Chapter 5 includes the conclusions, implications based on the study, and recommendations for further research.

Chapter 2

REVIEW OF LITERATURE

Introduction

Professional organizations, like the International Society for Technology in Education (ISTE), are hopeful that one could walk into a classroom and find teachers and students who are using technology for a variety of purposes (ISTE, 2011). As a previous instructional technology specialist in a large school district, I noticed a small proportion of teachers using technology to create and access lesson plans, communicate with parents and colleagues, and complete daily tasks related to their jobs. Even fewer students were using technology to complete day-to-day assignments or create projects that facilitated learning. Findings of the U.S Department of Education suggested that students are primarily using the Internet for research work and word processing to create reports (Judson, 2008). Allen (2001), states that technology plays an increasing role in teaching and learning at all levels of education. Although this is not the ultimate answer, incorporating educational technology into instruction has a huge potential for helping children (Keengwe & Onchwari, 2006) as well as building a child's self-concept and improving his/her attitude toward learning (Sivin-Kachala & Bialo, 1994).

An enormous amount of money and resources have been spent to improve availability of technology in education (Cuban, 2001; Oppenheimer, 2003). According to the Federal Communications Commission, 97 percent of schools across the country had Internet connectivity as of 2010 (FCC, 2011). Universities are spending up to $300,000 (T.H.E. Journal, year) per classroom for hardware, software, and supporting infrastructures in an effort to build rooms to enhance the teaching and learning experiences for students and faculty. Due to these substantial investments, the use of technology in the K-12 classroom has grown tremendously since the 1970s when computers were first introduced. Computing technology is rapidly and continuously changing (Liu & Szabo, 2009) but the way teachers use technology has changed slowly, especially over the past decade (Russell, O'Dwyer, Bebell, & Tao, 2007; Sinatra & Pintrich, 2003).

Despite these observations and investments, the integration of technology in classroom teaching is not as prevalent as one would think. In a four-year longitudinal study, Liu & Szabo (2009), collected data from 275 in-service teachers enrolled in a graduate teacher program. They found effective use of technology in the curriculum is still "seldom and not systematic" (p. 6). They observed that only a small number of teachers are even interested in integrating technology into their classroom instruction. Additional studies have confirmed these results by showing that teachers' use of computers is infrequent (Becker, 2000; Hanushek, 1998) and in ways that does not support learning (Becker 1994; ChanLin, Hong, Horng, Chang, & Chu, 2006; Cuban, 2001). Findings of a report from the National Center for Education Statistics showed only half of the public school teachers, who had computers or the Internet available, used them for classroom instruction (Smerdon, Cronen, Lanahan, Anderson, Iannotti, & Angeles, 2000). The most common technologies used were word processing and the computer for rote drills (Smerdon et al., 2000). Many schools have seen that their newly purchased and installed technologies often sit unused (Brown & Warschauer, 2006; Russell et al., 2007).

There are several barriers that have contributed to the lack of technology integration in the classroom. With national mandates like No Child Left Behind (NCLB) and standardized tests, teachers often cite the lack of time and energy as a reason for not learning to implement new classroom practices that employ technology (Dvorak & Buchanan, 2002; Keenagwe & Onchwari, 2009; Liu & Szabo, 2009). As a result, teachers have limited expertise in how to use computers and technology in their daily instruction (Preparing Tomorrow's Teachers to Use Technology [PT3], 2002). Others have suggested teachers do not see the connection between technology training and their curriculum (Dvorak & Buchanan, 2002), which contributes to ineffective technology implementation strategies (Duhaney, 2001; Krueger et al., 2000). Further, the rapid growth of technologies has made it difficult for teachers to see their potentials, affordances, and constraints that make them appropriate for one task over the others (Koehler & Mishra, 2008). Due to this, many teachers have received inadequate training on how to use new technologies throughout the teaching and learning process (Koehler & Mishra, 2009).

Teacher Preparation Programs

Today, students in teacher preparation programs are more comfortable using computers than ever before. This has lead many to assume that increased comfort levels would lead to more integration of technology. However, this has not been the case (Russell, Bebell, O'Dwyer, & O'Connor, 2003). In one study, Wetzel, Zambo, and Ryan (2007) used the *Integration of Technology Observation Instrument* (ISTE, 2003) to observe 18 experienced K-12 teachers and 28 beginning K-12 teachers who completed an educational technology course during their teacher preparation program. They found that experienced teachers used productivity tools twice as much and research tools four times as much as those who are early in their teaching careers. Additionally, the study showed that experienced teachers used a wider variety of technology tools than did their less experienced counterparts.

These findings beg the question: why are new teachers, who tend to have more experience with computers, less able to successfully integrate technology into their instruction? A common sentiment was that our preservice teacher preparation programs fall short with respect to training in the area of technology (Rowley, Dysand, & Arnold, 2005; Waddoups, Wentworth, & Earle, 2004). Findings from additional studies concur with this opinion adding that teacher preparation programs have not adequately provided preservice teachers with effective modeling of technology use or sufficient experiences with technology integration during their coursework (Brown & Warschauer, 2006; Kay, 2007; Lewallen, 1998; Smerden et al., 2000).

Brown & Warschauer (2006) point to a number of reasons for the lack of preparedness to integrate technology among teachers entering the profession. In their case study, 110 graduate students enrolled in an information technology course completed three different surveys; participated in group and individual interviews; and were observed during class time and student teaching experiences.

They found students were observing little technology integration in their methods courses. Additionally, the participants noted that their instructors viewed technology as playing a peripheral role in the teacher preparation experience. As a result, many programs have consigned technology preparation to a single educational technology course in which mastery of hardware and software functions took precedence over learning how to integrate technology into classroom teaching. This also demonstrated to students that learning how to use technology was a course that was thought of as separate part of their program, instead of being infused into their program.

In addition to the lack of exposure in their university courses, the modeling of technology integration was passed on to the supervising teacher in clinical experiences; a difficult task since many preservice teachers enter student teaching more proficient with computers than their supervising teacher (Hall, 2006). In a survey administered by Carlson & Gooden (1999), 410 student teachers responded that two-thirds of their supervising teachers used only word processing software in their implementation of technology integration. In another study, Brown & Warschauer (2006) attempted to make the connection between the university and K-12 classrooms. Several key findings emerged from this study: (a) preservice teachers had insufficient exposure to technology integration, especially to enhance higher-order learning, by their mentor teachers; (b) attempts by preservice teachers to integrate technology were overridden by the need to cover standard curriculum and to prepare students for testing; and (c) the use of technology was constrained by other demands placed on student teachers. Wetzel

& Williams (2004-2005) further substantiated these findings when they maintained students in teacher preparation programs were not seeing exemplary practices of technology integration during the field experiences. This ultimately led the student teacher to feel hindered in the ability to integrate technology into their experiences because they lacked the support needed from their supervising teachers (Hall, 2006).

These deficiencies during teacher preparation programs showed that university instructors and mentor teachers lacked technology knowledge necessary to successfully infuse technology throughout their courses and their classrooms. Based on these findings, several solutions have been developed regarding the unpreparedness of teachers entering the field. First, numerous studies recommended that university faculty need to be better prepared to model technology infusion into their courses (Adamy & Boulmetis, 2006; Best, 2002; Brown & Warschauer, 2006; Pope, Hare, & Howard, 2002; Waddoups et al., 2004; Zambo, Buss, & Wetzel, 1999). Next, students must also have received the opportunity to practice integrating technology throughout their entire teacher preparation programs (Brent, Brawner, & Van Dyk, 2003; Pope et al., 2002). Finally, it has been recommended that preservice teachers should be placed with technology-proficient mentors (Adamy & Boulmetis, 2006; Best, 2002; Brown & Warschauer, 2006; Waddoups et al., 2004).

The current study addressed these issues by providing professional development to university course instructors so that they could more effectively integrate technology throughout their content and methods courses. This study was conducted to reveal whether students perceived technology as a peripheral concept or one that should be woven throughout the curriculum. The study also sought to determine whether students observed technologies being appropriately modeled by experienced instructors and whether they ha the opportunity to interact with various technologies through hands-on activities. Thus, the issue being examined was whether extensive exposure to various educational technologies can helped address a number of the concerns registered in the literature above.

Professional Development

Based on the previous literature, it was clear that teacher preparation programs must do a better job at preparing teachers to integrate technology both in the university classroom and during field placements. To meet these needs, professional development has been proposed as the typical answer. Each year, universities, school districts, and the federal government have expended millions of dollars providing in-service trainings, and other forms of professional development, that Borko (2004) called "fragmented, and intellectually superficial" and "woefully inadequate" (p. 3). Additionally, Sykes (1996) agreed that professional development was a huge problem, when he stated that conventional professional development continued to be "the most serious unsolved problem for policy and practice in American education today" (p. 465).

Programs such as PT3 were developed to address these deficiencies by providing professional development to prepare future teachers to use technology for the advancement of learning and achievement (Brown & Warschauer, 2006).

Likewise initiatives such as partnering technology-savvy students with university faculty (Denton, Davis, Strader, Clark, & Jolly, 2003; Wedman & Diggs, 2001), teacher collaboration in K-12 environment (Zambo et al., 2001), the creation of partnerships between public schools and the universities (Chitiyo & Harmon, 2009), and faculty-as-students (Popham & Rocque, 2004) have provided positive results in the area of professional development.

Currently, models such as Technological Pedagogical Content Knowledge (TPACK) have come to the forefront of thinking about integrating technology (Mishra & Koehler, 2006). Those who developed the model emphasized that there is no “one best way” to infuse technology into the classroom. By combining the three knowledge bases (content, pedagogy, and technology), teachers were expected to plan technology integration to meet the needs of the content in the appropriate context of the needs of the classroom (Mishra & Koehler, 2008).

Regardless of approach, three key pieces have ben identified as being essential to any strong professional development program. Borko’s (2004) model (see Figure 1) suggested that a technology facilitator, the instructors, and an effective professional development program were represented within the context of the educational setting of the instructors receiving the professional development. Judson (2006) agreed with this notion that professional development for integrating technology must be specific to the context of the course or setting.

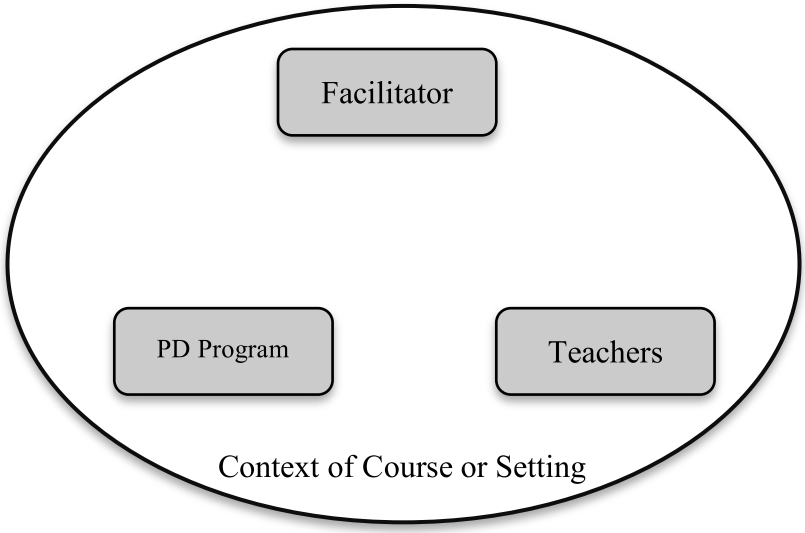

Figure 1. Adapted from Borko's Professional Development Model

The figure above displays the key pieces of any professional development model. However, as noted in the literature, there are a number of components that go into the successful implementation of professional development. In a study by Strudler and Wetzel (1999), the authors recommended five key characteristics of exemplary programs for integrating technology across programs: (a) adequate support for technical and curriculum integration; (b) a variety of professional development options; (c) faculty and student access to hardware and software; (d) educational technology specialists; and (e) reward structures for participation.

Rodriquez and Knuth (2000) provided an expanded list of components of professional development for effective technological integration that included: (a) connection to student learning; (b) hands-on technology use; (c) a variety of learning experiences; (d) curriculum specific applications; (e) active participation by instructors; (f) sufficient time to implement new knowledge; (g) technical assistance; (h) support from administration; (i) adequate resources; and (j) continuous funding.

It is apparent that one major challenge facing teachers is how to effectively integrate technology to help students become active participants in the learning process (Bauer & Kenton, 2005). However, promoting change within any educational organization or institution involves a multidimensional approach (Cradler, Freeman, Cradler, & McNabb, 2002) with adequate professional development as a key component of change (Becker, 2000).

Researchers have advocated that teachers need a range of professional development opportunities and approaches (Hall, 2006). Others have noted successful professional development should (a) include modeling of pedagogical strategies; (b) provide time for participants to implement their new understandings; and (c) provide the opportunity for reflection (Cleland, Zambo, Buss, Wetzel, & Rillero, 2003). Additionally, participants typically viewed professional development as being successful if it is focused on their specific needs and just-in-time support for their learning (Cradler et al., 2002; Feist, 2003).

Findings from several studies showed effective professional development can indeed produce changes in pedagogy related to technology integration. Findings from Zambo et al. (2001), demonstrated that allowing teachers to participate in a community of teachers who had similar interests helped them plan learning activities that ultimately led to the integration of technology in their curriculum. Hall (2006) conducted a case study of a four-year professional development program funded by a PT3 grant. The study, that included data collected from teacher education faculty, university faculty, and project coordinators, found similar improvements in technology skills, changes in pedagogy, and the integration of technology occurred because of effective professional development.

As discussed previously, the PT3 program goals were to infuse technology throughout teacher education courses so that new teachers would be better prepared to integrate technology into their K-12 classroom teaching. Survey results from a three-year longitudinal study that included 41 university faculty members showed an increase from 20.6% to 69.2% of college faculty members who engaged in planning and implementing technology over that period (Wetzel & William, 2004-2005). This particular program provided opportunities for participants to share ideas and reflect on their teaching approaches. As a result, participants noted that their teaching practices changed from being lecture-oriented to being project-based, which allowed more collaboration among students. This led teachers to change their thinking about using technology to effectively teach their content (Zambo et al., 2006). These findings were similar to those obtained by Becker (1994), who found that collaboration and small group work supported exemplary computer use.

Professional development can take many forms. Male (1994) suggested (a) modeling appropriate uses of technology integration, (b) allowing time for practice, (c) providing immediate feedback and time to adapt the curricula to the different technologies, (d) peer coaching, and (e) periodic check-ins by a professional development facilitator all had a positive influence on the integration of technology. Further, Brill and Galloway (2007) noted that these kinds of professional development opportunities afforded instructors occasions to develop proficiencies for selecting the most useful technologies for their classroom goals.

Peer coaching has been shown to be an effective model for providing professional development (Barron, Dawson, & Yendol-Hoppey, 2009; Huston & Weaver, 2008). Barron et al. (2009) evaluated a peer-coaching program that included 60 peer-coaching facilitators and coaches who were K-12 teachers and district-level supervisors. Results from their mixed methods study indicated both coaches and facilitators were enthusiastic about the program and had an increased attitude toward the integration of technology. In another study, results from a three-year peer coaching project of 10 university faculty members along with an analysis of the previous literature on the topic, led Huston and Weaver (2008) to produce six recommendations for peer coaching: (a) goal-setting; (b) voluntary participation; (c) confidentiality; (d) assessment; (e) formative evaluation; and (f) institutional support. These findings were consistent with previous studies focusing on effective professional development (Rodriquez & Knuth, 2000; Strudler & Wetzel, 1999).

The idea of including a *community of practice* in a professional development setting has gained momentum over the past decade (Smith, 2008). Originally developed by Jean Lave and Etienne Wenger (Lave & Wenger, 1991; Wenger, 2000) to account for learning in groups, a community of practice is a group of people who are engage with each other on a regular basis to achieve a common undertaking. Wenger (2009) described three characteristics that define a community of practice. First, the community has a shared *domain* of interest and also a commitment to that interest. Second, the *community* engages in collaborative activities and discussions to share information and help each other learn. Finally, the members of a community of *practice* are practitioners. The group members share resources, experiences, and tools to be successful. In sum, a community of practice is constituted of a group that has a mutual experience over time, and that is committed to a shared understanding (Eckert, 2006; Wenger, 2009).

Communities of practice develop through a variety of activities, including: problem solving, requests for information, seeking experience, reusing assets, coordination and synergy, discussing developments, documentation projects, visits, and mapping knowledge and identifying gaps (Wenger, 2009). The current study used several of the community of practice activities to help facilitate the professional development process outlined in the method section.

The current study addressed effective professional development approaches in a number of ways. First, it will include a number of the recommendations provided above (Huston & Weaver, 2008; Rodriguez & Knuth, 2000; Studler & Wetzel, 1999). This includes: (a) offering a variety of professional development options such as one-on-one coaching, recorded sessions that can be played back at later times, and collaboration among peers; (b) time to implement their new knowledge by providing professional development over an extended period of time; (c) hands-on learning with all of the technologies that are part of the program; and (d) adequate technical and curricular support.

Self-Efficacy, Attitudes, and Utilization of Educational Technology

As professional development programs begin to infuse technology into content areas at both the K-12 and university levels, it is important to note that just training teachers to use technology will not be sufficient. In the past, teachers viewed educational technology as a *peripheral* component to education and not as a tool that can enhance instruction. Teachers need to see the value of technology to support curriculum change and not to just use technology for the sake of using technology (Wetzel et al., 2001).

Today, more instructors see the value of using technology in the classroom, especially in ways that will help present information and examples, maintain interest, and actively engage students in higher-level thinking. In a study examining college-level instructors' use of and attitudes toward classroom-based teaching technologies, Brill and Galloway (2007) found that most instructors felt that technology had a positive influence on their teaching and students' learning. The instructors expressed a strong desire to have each student on a computer so that they could take advantage of web-based technologies in an effort to enhance their traditional teaching practices. Additionally, their participants expressed an interest in using more sophisticated computer-based technologies.

Despite the position of professional organizations, like ISTE, that espouse positions that technology should fully embedded in classrooms (ISTE, 2011), technology is not being used to support the kinds of instruction believed to be most appropriate (Ertmer & Ottenbreit-Leftwich, 2010). Teachers simply do not know how to appropriately integrate technology or are unwilling to try because of anxiety, lack of motivation, and lack of interest (Duhaney, 2001; Keengwe, 2007). The U.S. Department of Commerce statistics show that education is last in technology use among 55 U.S. industry sectors (Vockley, 2008). Although researchers noted that K-12 and university teachers are very interested in new methods of teaching with technology, there are barriers that inhibit technology use. First, the teachers felt they could not keep up-to-date with the rapidly evolving technologies and they were unsure how to effectively implement technologies into their classrooms (Keengwe & Onchwari, 2009; Roblyer, 2006). Similarly, teacher's attitudes toward educational technology is an important factor on the adoption of technology in the classroom (Roblyer & Knezek, 2003).

In addition to a lack of technology skills, motivation, and interest in integrating technology into the classroom, teacher attitudes toward technology is a predominant theme in the literature that influences the likelihood of integrating technology. Results from several studies have shown attitude is a strong factor in predicting teachers' and student teachers' intention to use technology with students (Ajzen, 1988; Atkins, & Vasu, 2000; Bitner & Bitner, 2002; Roblyer & Knezek, 2003; Taylor & Todd, 1995). Those teachers who have more positive attitudes toward technology use are more likely to integrate various educational technologies in their classrooms on a regular basis.

Moreover, the personal use of computers unrelated to teaching activities was an important predictor of future technology integration into the classroom. This has implications because students who are comfortable with technology often have more positive attitudes about the importance of integrating technology into their teaching (Wozney, Venkatesh, & Abrami, 2006) Therefore, proper instruction in teacher preparation programs and professional development can improve attitudes toward computers and technology integration (Brown & Warschauer, 2006; Kluever, Hoffman, Green, & Swearingen, 1994).

In an effort to improve teachers' confidence in, efficacy for, attitudes toward, and integration of technology, we must first address the experiences they are receiving in their teacher preparation programs. Rather than participating in interactions with technology through stand-alone educational technology courses, it is clear students can benefit from technology exposure and use throughout their teacher preparation program. Implementation of this technology-infused approach, is outlined in the next chapter, which provides details about how students will received increased exposure and opportunities to practice with a variety of educational technologies in their methods courses of their teacher preparation programs.

TPACK

This study used Koehler & Mishra's (2009) Technological Pedagogical Content Knowledge (TPACK) model as the theoretical framework for implementing technology integration (see Figure 2). This framework builds on Shulman's (1987) idea of pedagogical content knowledge (PCK) and additionally incorporates technology knowledge. TPACK combines expertise from a variety of areas to successfully integrate technology throughout the curriculum. The model stresses that there is not "one best way" to integrate technology into curriculum (Koehler & Mishra, 2009).

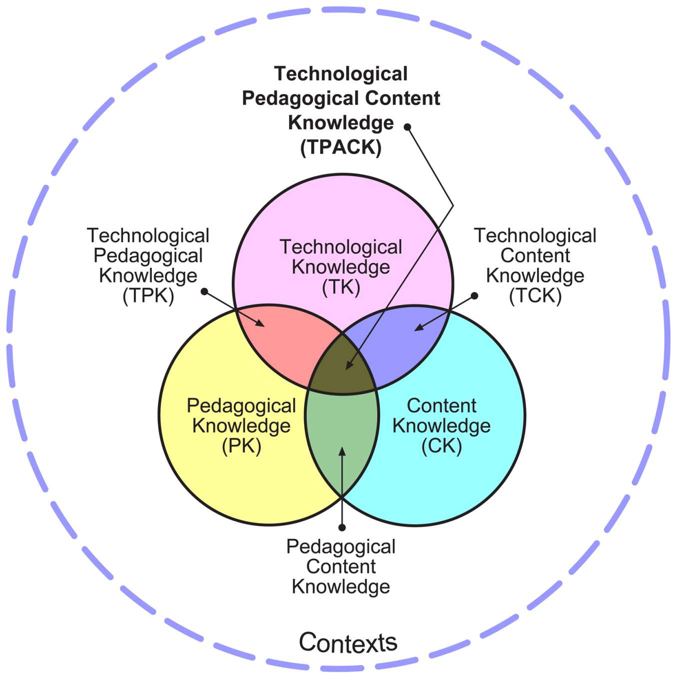

Figure 2: The TPACK framework and its knowledge components. Adapted from http://tpack.org/, with permission.

Three main components constitute the TPACK model: (a) content knowledge; (b) pedagogical knowledge; and (c) technological knowledge. Content knowledge (CK) is the teachers' knowledge about the content being taught. Shulman (1986) states that content knowledge would include knowledge of concepts, theories, ideas, organizational frameworks, knowledge of evidence and proof, as well as established practices and approaches toward developing such knowledge. Pedagogical knowledge (PK) is the teachers' knowledge about the processes and practices or methods of teaching and learning. Pedagogical knowledge requires the teacher to have a deep understanding of several different theories of learning and how they apply to students in the classroom (Koehler & Mishra, 2009). Technological knowledge (TK) is the most fluid of the knowledge components which makes it the most difficult to define. In a report from the

National Research Council (NRC, 1999), the authors argued that technological knowledge should go beyond basic computer literacy to include the idea that people should be able to understand and apply technology appropriately in their everyday lives and adapt as necessary.

Within the TPACK model there are four interactions among the main types of knowledge: (a) Pedagogical Content Knowledge (PCK) is the ability to apply knowledge of pedagogy to specific content; (b) Technological Content Knowledge (TCK) is the ability to understand how technology and content influence and constrain each other; (c) Technological Pedagogical Knowledge (TPK) is the ability to understand how teaching and learning can change when technologies are used in appropriate way; and (d) Technological Pedagogical and Content Knowledge (TPACK) is the ability to understand the interactions among content, pedagogy, and technology that can lead to "meaningful and deeply skilled teaching with technology" (Koehler & Mishra, 2009, p. 66).

TPACK has been the focus of a number of studies over the past few years (Archambault & Crippen, 2009; Brush & Saye, 2009; Guzey & Roehrig, 2009). Archambault & Crippen (2009) studied the correlation between TPACK components and interactions during online teachers. Using survey data from 596 K-12 online teachers, the researchers found that there were high ratings for content knowledge (CK), pedagogical knowledge (PK), and content pedagogical knowledge (CPK). However, the participants responded much lower to the technological components of the survey (TK, TPK, and TCK) indicating that teachers were not as confident about integrating technology with content and pedagogy.

In a multicase study examining a professional development program, Guzey and Roehrig (2009) used the TPACK model to help their participants focus on the integration of technology to support science inquiry in K-12 classrooms. They found a relation between the teachers' development of TPACK and their pedagogical skills. This indicated that teachers who had an understanding and appreciation for a constructivist approach to teaching tended to be more likely to integrate technology into their classroom (Judson, 2006; Liu & Szabo, 2009; Ravitz, Becker, & Wong, 2000; Windschitl, & Sahl, 2002).

Overview of the intervention. The program being implemented in this study used the TPACK model as a guide for the professional development program. The collaboration between the researcher and the instructors allowed for each component of TPACK to be addressed. The InMAC instructors were teaching graduate level courses in their content area so it was apparent that they had a strong background on the CK component. The researcher, a former educational technology specialist and a current instructor taught educational technology courses, had expertise in the TK component. The InMAC instructors and the researcher were veteran teachers who used a wide range of pedagogical approaches as they taught their courses. This dual-expertise allowed both to contribute to the pedagogical knowledge (PK) of the professional development program. Based on these varying types of expertise, Figure 3 displays an adapted

TPACK model that demonstrates the expertise the researcher and instructors brought to the professional development program.

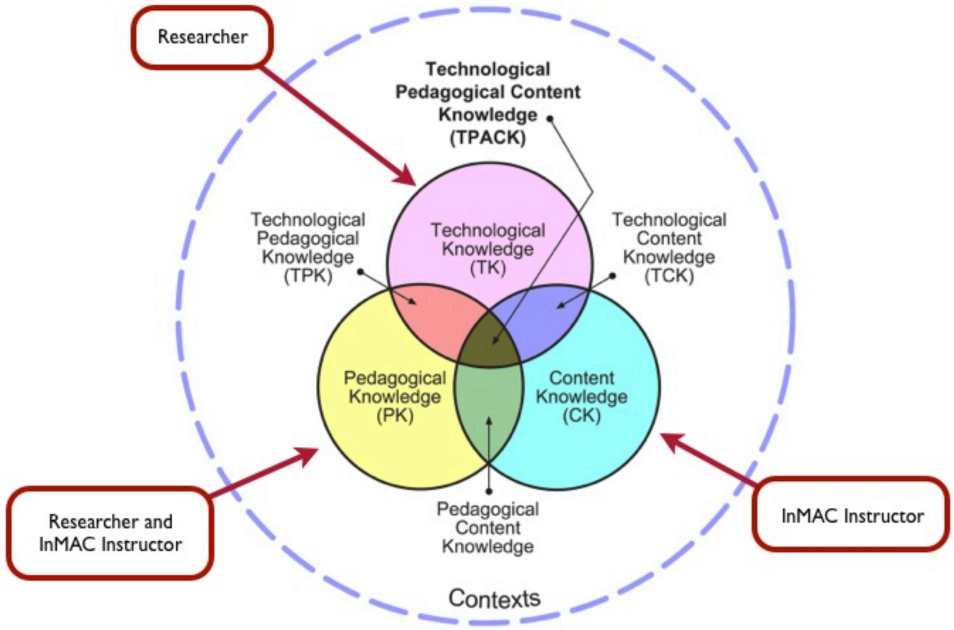

Figure 3: Adapted TPACK framework for the iCAT program

Summary of Literature Review

Few argue that technology will not continue to become increasingly commonplace in students' lives. As the availability of technology increases, the manner in which teachers teach must dramatically change as well (Smerdon et al, 2000). To increase the integration of technology into instruction, teachers need to learn specific ways to integrate technology that will improve students' learning (Hall, George, & Rutherford, 1997). Specifically, the opportunity for teachers to participate in professional development will be essential to continued efforts to increase technology integration in school classrooms. Further, these professional development opportunities should be provided in a variety of ways, allow for hands-on interaction, and allow for sufficient time and support so that teachers can be successful (Huston & Weaver, 2008; Rodriguez & Knuth, 2000; Studler & Wetzel, 1999). Finally, technology integration specialists and technical help should be made available so teachers can get support when they feel it is needed (Keengwe & Onchwari, 2009).

The TPACK model provides a solid foundation for an effective professional development model that fosters the integration of technology into classroom settings. Teachers often have the pedagogical and content knowledge but they lack technology knowledge to successfully integrate technology into their classrooms (Archambault & Crippen, 2009). The integration of technology into the classroom can be increased by offering a variety of hands-on, interactive professional development opportunities for technology integration led by someone who has considerable expertise in technology knowledge, TK from the TPACK model. If these efforts are accompanied by sufficient time to implement their new knowledge and adequate technical and curricular support, the integration of technology can be further enhanced (Huston & Weaver, 2008; Rodriguez & Knuth, 2000; Studler & Wetzel, 1999).

Chapter 3

METHODOLOGY

This chapter describes the participants, how they were selected, the intervention and procedure, the data collection instruments and the data analysis.

Setting

This study took place at one of the four campuses at a large urban university in the southwestern United States. The university includes one of the largest teacher preparation programs in the country, offering degrees and teacher certification to undergraduate and graduate students.

One of the programs offered through the university's teacher college is a two-year, InMAC program (Induction, Master of Education and [State] Certification), an alternative pathway to teacher certification for non-traditional students who are entering the teaching profession with little or no teaching experience, but who have already earned an undergraduate degree. The students in this program are seeking Masters Degrees in Education in elementary, secondary, or special education. Upon completion of the program, the students will have earned a provisional teaching certificate for the state in which the program is offered.

This program includes affiliations with Teach for America, [State] Teaching Fellows, and [State] Department of Education—Alternative Pathways to Teacher Certification. Those selected to the participate in the graduate program have successfully met the criteria below:

- Secured a full time position as the teacher of record in a K-12 school;
- Completed a Bachelor's or advanced degree;
- Completed a 45 hour Structured English Immersion (SEI) course;
- Obtained a passing score on the [State] Proficiency Exam or Praxis Subject Knowledge Exam;
- Obtained an Identity Verified Print (IVP) Fingerprint Clearance Card; and
- Obtained an Intern Teaching certificate.

This certificate allows them to be enrolled in the teacher certification program while teaching full time until they have met the requirements to receive their Provisional Certificate. The students are paid a full teacher's salary. Students who are affiliated with Teach for America receive tuition waivers each fall worth approximately $5,500. Likewise, [State] Teaching Fellows receive AmeriCorps funding in the amount of $5,550 during the first semester of the program. These students must remain in good academic standing to receive the same funding the following fall.

To successfully complete the 48-credit-hour program, students must take 33 hours of course work and complete an applied project to earn a Masters in Education. As well, the students must complete an additional 15 hours of course work to earn teacher certification. To ensure students complete the program in two years, 12 credit hours of coursework must be completed each semester. Students work in cohorts and follow an identical path from the start of the program to its completion. Each semester, the students enroll in two hybrid courses and two face-to-face courses. The hybrid courses are eight-weeks in length with one starting the first eight weeks (Session A) and the second course (Session B) starting at the conclusion of the first. The first face-to-face course (Session C) is fifteen-weeks in length and runs throughout the entire semester. The second face-to-face course (Session D), entitled *Apprentice Teaching*, is conducted as a Community of Practice in which students discuss their teaching methods and reflect on their experiences.

Participants

This study included a purposeful and convenience sample of instructors and their students selected from the InMAC program. In all, there were a combined 279 students enrolled in the first or second year of the program. The students all entered the program with undergraduate degrees in content areas other than the field of education. The demographics for the student population are summarized below in Tables 1 and 2.

Table 1

InMAC Students Enrolled During the 2011-2012 Academic Year

Population	Total N	1st Year Students	2nd Year Students	Mean Age	EED Majors	SED Majors	SPE Majors
All	279	143	136	24.76	89	127	62
Male	89	48	41	25.79	19	53	16
Female	190	95	95	24.27	70	74	46

Table 2

Ethnicity of InMAC Students for the Year of their Entrance into the Programs

Ethnicity	EED 2010	EED 2011	SED 2010	SED 2011	SPE 2010	SPE 2011	Total
White	22	43	58	43	28	8	202
Black	1	3	4	3	5	3	19
Hispanic	4	6	3	9	4	3	29
Native American	0	2	0	0	1	0	3
Asian/Pacific Islander	2	2	2	2	2	3	13
Not specified	4	1	1	2	3	2	13

For students to be selected to participate in the study, the students' course instructors had to accept an invitation (see Appendix A) and meet the program criteria listed below:

1. Teach at least two sections of the same class during the Spring 2012 semester.
2. Volunteer to modify one section of the course to integrate technology. The other section would remain consistent with the way it was previously taught.
3. Agree to meet with researcher and other participating instructors at least five times throughout the course of the Spring 2012 semester.
4. Document the use of technology in their classes by both the instructors and students and record any differences they noticed between the two sections.

**These criteria will be further defined in the Procedures section of Chapter 3.*

The second criterion was important because it allowed the researcher to control for the instructor variable; the instructor had to be teaching the same course to two different sections of students. One section received the intervention entitled Integration of Content and Technology (iCAT) whereas the other section did not receive the iCAT intervention. The instructor taught the other section as it had been done in the past. This allowed the researcher to compare technology integration intervention between the two sections. There was no reason to suspect that the students in the two sections are dissimilar.

Of the fifteen full-time InMAC instructors, four instructors met the criteria and agreed to participate; four instructors met the criteria but did not respond to the invitation; and seven instructors did not meet the criteria and were therefore eliminated from consideration. Because of the unique organization of the InMAC program, the course length varied from course to course. However, the student participants for this study all completed two, three-credit hour course(s). In all, four cohorts of students participated in this study. Two received the iCAT intervention and two served as the control group. Table 3 displays the instructors who volunteered, the cohorts that they taught, and the location in the program of students during the Spring 2012 semester. It is important to note that two cohorts were first-year students and the other two cohorts were second-year students. Additionally, all four cohorts were enrolled in the elementary education program (EED). In all, approximately 42 students were enrolled in a cohort that received the iCAT program intervention and 48 students were enrolled in a cohort that did not receive the iCAT program intervention. Instructors 1 and 2 taught the same two cohorts during the semester. Likewise, Instructors 3 and 4 taught the same two cohorts during the semester.

Table 3

Overview of Intervention and Control Cohorts

Instructor	Instructor 1 Instructor 2		Instructor 3 Instructor 4	
Cohort	I	C	I	C
Students	28	30	14	18
Intervention	Yes	No	No	Yes
Year in program	1st		2nd	

*I: Treatment group; C: Control group

Data Sources

This mixed-methods study included both quantitative and qualitative methods of data collection. The data collection occurred concurrently, meaning that the data were collected throughout the intervention from the various groups and then brought together to allow a comprehensive analysis of the data to answer the research questions (Creswell, 2007). This study utilized several methods of gathering data from both students and clinical instructors. Student participant data included a pre- and post-intervention questionnaire and focus group interviews. The clinical instructors' data included a weekly reflection log, analysis of the course syllabi, an interview near the end of the semester, and informal field notes gathered by the researcher. The pre-intervention questionnaire data was obtained at the beginning of the Spring 2012 semester. The post-intervention questionnaire was obtained and the focus group interviews occurred near the end of the Spring 2012 semester. The remaining data sources (the instructors' reflection logs, informal field notes, and the researcher's journal) were gathered throughout the semester. In Tables 4 and 5, information about the data collection, data analysis procedures, and the collection timing are summarized for the various cohort groups of students participating in the study.

Table 4

Research Questions and Quantitative Data Sources

Research Question	Data Source	Analysis	Timing
1. How and to what extent were there differences in confidence, self-efficacy, attitude, and utilization of educational technology for in-service teachers who: a. completed two, three-credit hour graduate courses where educational technologies were integrated throughout both courses versus those who completed two, three-credit hour graduate courses where educational technologies were not integrated throughout both courses; and b. completed two, three-credit hour graduate courses and had already completed a stand-alone educational technology course (EED 531 – Teaching with Educational Technology) during their graduate program? 2. How and to what extent were confidence, self-efficacy, attitude, and utilization of educational technology predicted from modeling and hands-on exposure that in-service teachers experienced during a graduate course(s)?	Pre-Intervention Questionnaire provided baseline data to determine group differences Post-Intervention Questionnaire addressed all three RQs	Mean comparison RQ1: Repeated measures analysis of variance (RM ANOVA) on confidence, self-efficacy, attitudes, and integration of technology RQ2: Step-wise regression using groups, modeling, and hands-on interaction as predictors	Pre-intervention questionnaire administrated during the first class session Post-intervention questionnaire administered during the second-to-last class session

Table 5

Research Questions and Qualitative Data Sources

Research Question	Data Source	Analysis	Timing
1. How and to what extent were there differences in confidence, self-efficacy, attitude, and utilization of educational technology for in-service teachers who: a. completed two, three-credit hour graduate courses where educational technologies were integrated throughout both courses versus those who completed two, three-credit hour graduate courses where educational technologies were not integrated throughout both courses; and b. completed two, three-credit hour graduate courses and had already completed a stand-alone educational technology course (EED 531 – Teaching with Educational Technology) during their graduate program? 2. How and to what extent were confidence, self-efficacy, attitude, and utilization of educational technology predicted from modeling and hands-on exposure that in-service teachers experienced during a graduate course(s)?	Focus Group Transcripts of participants Instructors' reflection logs Informal field notes of classroom observations Researcher journal	Constant comparative method Coding assembled into categories, themes, and patterns	Concurrent – no sequence The focus group interviews took place during the final weeks of the spring 2012 semester Instructors' reflection logs were completed on a weekly basis

Questionnaire. All participants were asked to complete a pre-intervention questionnaire at the beginning of the spring 2012 semester. The same students were then asked to complete a post-intervention questionnaire near the end of the spring 2012 semester. The students included an identifying number so that the results of the pre- and post-intervention questionnaires could be compared during data analysis.

The pre-intervention questionnaire used for this study included 57 Likert-type items organized into three sections. The first two sections of the questionnaire asked the participants to report the extent of their uses and exposure to fifteen different technologies. In Section I, participants were asked to indicate their level of confidence in using the different technologies on a six-point scale (6 = *extremely confident;* 5 = *highly confident;* 4 = *quite confident;* 3 = *somewhat confident;* 2 = *a little confident;* and 1 = *not at all confident*). For example, one item read, "Indicate the level of confidence you have using Google Docs." In Section II, participants were asked to indicate their frequency of integration of the different technologies into classroom instruction on a six-point scale (6 = *use it extensively*; 5 = *use it a lot*; 4 = *use it quite a bit*; 3 = *use it somewhat*; 2 = *use it a little*; and 1 = *do not use it at all*). An example of an item read, "How frequently do you integrate the Internet as a learning tool into your classroom teaching?" In Section III, participants were asked to respond to twenty-seven different statements on a six-point scale (6 = *strongly agree*; 5 = *moderately agree*; 4 = *slightly agree*; 3 = *slightly disagree*; 2 = *moderately disagree*; and 1 = *strongly disagree*). The first twenty items related to the students' self-efficacy when using educational technology in the classroom. An example of one item read, “I feel prepared to integrate educational technology with my students.” The final seven items related to students’ attitudes toward the use of educational technology in their classroom. For example, one item read, “I feel good about using technology.” The questionnaire also had participants complete several demographic items including, for example, “In which program are you enrolled?” The pre-intervention questionnaire can be found in Appendix F.

The post-intervention questionnaire used for this study included 87 Likert-type items organized into five sections. Sections I, II, and III were identical to the pre-intervention questionnaire. Section IV of the post-intervention questionnaire required the participants to indicate the frequency they observed the different technologies being modeled during their course on a four-point scale (3 = *modeled a great deal*; 2 = *modeled moderately*; 1 = *modeled a little*; and 0 = *not modeled at all*). Section V of the questionnaire required the participants to indicate the frequency with which they have hands-on experience using the different technologies during their course on a four-point scale (3 = *a great deal of hands on experience*; 2 = *a moderate amount of hands on experience*; 1 = *a little hands on experience*; and 0 = *no hands on experience*). The questionnaire also required participants to complete several demographic items such as the class they were taking, year in the program, semester in the program, and so on. The post-intervention questionnaire can be found in Appendix G.

In preparation for this study, the post-intervention questionnaire was piloted in the fall 2010 semester in which 119 InMAC students completed the questionnaire (Kisicki, Buss & Wetzel, 2010). A reliability analysis was conducted using Cronbach's alpha coefficient to determine the reliability of the instrument for Sections I, II, IV and IV. As displayed in Table 6, the alpha reliability coefficients for each section indicated that the questionnaire was a reliable instrument.

Table 6

Reliability Scores for Questionnaire

Questionnaire Section	Cronbach Alpha
Section I: Confidence Using Technology	.90
Section II: Frequency of Integration in Classroom	.86
Section IV: Modeled in Graduate Program	.90
Section V: Hands On Experience in Graduate Program	.90

To gain a clearer picture of the 27 efficacy and attitude items in Section III of the questionnaire, the responses were analyzed using SPSS, also known as Statistical Package for Social Sciences. A factor analysis with varimax rotation was performed on the 27 items. According to Gorsuch (1983), the factor analysis aids the researcher in conceptualizing the relationships among variables in an accurate manner. Factor loadings higher than .50 and with a difference of at least .15 between the next closest loading for that item on another factor were identified as having simple structure and thus, the item was considered to load on that particular factor. Table 7 displays the factor loadings for each of the 27 items. Factor loadings for which there was less than a .15 difference between two loading values for a single item were considered to have no simple structure. For formatting purposes, the labels have been abbreviated. The entire item statement stem can be found in Section III on the post-intervention questionnaire Appendix G. To illustrate, item 21, "I feel good about using technology" has a loading of .612 on factor 1, the "Attitudes toward using technology" factor and negligible loadings on the other factors. In a similar way, item 11, "I can teach using Web 2.0 tools," has a factor loading of .861 on factor 2, "Teaching unfamiliar technologies" and negligible loadings on the other factors.

Table 7

Factor Analysis of Efficacy and Attitude Items from Questionnaire

Technology	F1	F2	F3	F4	F5
1. Prepared to integrate with students	.612	-	-	-	-
2. Prof dev from my school			No simple structure		
3. My graduate program preparation			No simple structure		
4. I can teach Office	-	-	-	-	.838
5. I can teach the Internet	-	-	-	-	.862
6. I can teach CRS			No simple structure		
7. I can teach Google Earth	-	.627	-	-	-
8. I can teach Interactive Boards			No simple structure		
9. I can teach Video Conf	-	.819	-	-	-
10. I can teach Screencasts	-	.892	-	-	-
11. I can teach Web 2.0	-	.861	-	-	-
12. I can teach SNS	-	.620	-	-	-
13. I can integrate educational technology	-	-	-	.785	-
14. I can motivate my students using tech	-	-	-	.697	-
15. I understand the need to use ed tech	-	-	-	.703	-
16. I can use tech for critically thinking			No simple structure		
17. Fewer behavior prob when I use tech	-	-	.762	-	-
18. I can assess my students who use tech	-	-	.677	-	-
19. I can teach my students to use ed tech	-	-	.598	-	-
20. I can get students to do well by tech	-	-	.593	-	-
21. I feel good about using technology	.844	-	-	-	-
22. Technology is a great aid to education	.747	-	-	-	-
23. I have a better attitude toward tech	.832	-	-	-	-
24. I am a 21st century learner	.849	-	-	-	-
25. I am happy with how I use tech			No simple structure		
26. Tech makes teaching easier	.593	-	-	-	-
27. Students are engaged when I use tech	-	-	.652	-	-

Based on the results from the factor analysis, five factors emerged: (1) Attitudes toward using technology; (2) Teaching unfamiliar technologies; (3) Benefits of using technology; (4) Technology preparedness; and (5) Teaching everyday technologies. A reliability analysis was conducted using Cronbach's alpha coefficient to determine the internal consistency of the each of the five factors.

As displayed in Table 8, the alpha coefficients for each factor indicated that the items loading on that factor were consistent and resulted in reliable subscales.

Table 8

Reliability Scores for Factors Associated with Efficacy and Attitude Items on Questionnaire

Factor	Cronbach Alpha
Attitudes toward using technology	.90
Teaching unfamiliar technologies	.88
Benefits of using technology	.85
Technology preparedness	.83
Teaching everyday technologies	.96

Focus Group Interviews. Students from the treatment and control cohorts were asked to volunteer to participate in one of three focus group interviews with group sizes ranging between 5 and 12 participants. Treatment and control group participants were separated for the interviews so the two groups were not mixed together during an interview. Each interview had a heterogeneous mix of students based on their pre-intervention questionnaire confidence scores. Krueger (1994) describes focus groups as “a carefully planned discussion designed to obtain perceptions on a defined area of interest in a permissive, nonthreatening environment” (p. 6). The goal of the focus group interview is to stimulate a discussion that helps the researcher to see things from the participants’ perspectives, in this case educational technology in the students’ graduate program and classroom teaching. The focus group setting allowed participants to build on the discussion of other group members. Each interview consisted of seven open-ended questions designed to add substance to results of the questionnaire (Creswell, 2007) and to further assess participants’ self-efficacy for technology use, attitudes toward technology integration, and utilization of technology, as described in the previous section. The focus groups were conducted using established procedures, such as questions being posed in a balanced manner in an effort to avoid leading questions (Schofield, 1995). Additionally, the researcher took notes and video recorded the focus group interviews (Krueger, 2006). The recordings were later transcribed to review the participants’ comments. Two examples that illustrated the nature of the focus group questions are: “How has your attitude toward integrating various educational technologies changed since the start of this semester?” and “How has your integration of various educational technologies changed since the start of this semester?” The complete set of focus group interview questions can be found in Appendix H followed by the focus group interview recruitment protocol in Appendix I.

Instructors' Documentation. The researcher created a website (https://sites.google.com/a/asu.edu/icat-program/home) that linked all of the instructors' information and documentation (see screenshot of site in Appendix J). Each instructor collaborated with the researcher to keep a meeting log (Appendix K) that included all face-to-face, collaborative, and virtual meetings between the parties. Additionally, the instructors participated in a community of practice that allowed the instructors and the researcher to share ideas, successes, concerns, etc. throughout the iCAT program. Documentation of these meetings was also included in the instructors' meeting logs. Finally, each instructor completed a reflection form at the end of each week in which they responded to questions about how they interacted with both the treatment and control groups. The form asked the instructor to respond to the following questions:

1. How did you model/use technology in your class this week?
2. How did your students use technology in your class this week?
3. What would you have done the same (or differently) if you had the opportunity to do it again?
4. Did you notice any differences between the two sections of classes this week?

The instructors also had the opportunity to add any additional comments that were not addressed in any of the questions. Instructors completed this form to check that the intervention was implemented with integrity. A copy of the documentation form can be found in Appendix L followed by the instructor reflection log reminder protocol in Appendix M.

Procedure

During this study, the research actions were implemented systematically. First, the researcher recruited InMAC instructors to volunteer for the iCAT program. The recruitment occurred in the form of an email to all 16 full-time InMAC instructors (see Appendix A). As mentioned previously, four instructors met with the researcher and verbally agreed to participate.

Once the participants were identified, an initial meeting with the four instructors was conducted in which the researcher described the program and answered any questions the participants had. During that meeting, the researcher again asked each participant if they agreed to follow the criteria for participating in the iCAT program. If the participant agreed, he or she was asked to sign a letter of consent agreeing (Appendix B) to follow the iCAT program.

iCAT Program. The iCAT program was designed to combine a variety of professional development and learning approaches to help InMAC instructors effectively integrate technology into their courses. Using face-to-face, screencasts, and virtual and live communities of practice sessions with the researcher and colleagues, the instructors participated in a sustained professional development program during the spring 2012 semester. Appendix K provides a sample time log that instructors followed.

Overview. Each instructor met with the researcher between seven and 13 times throughout the semester to:

- create course goals for integrating technology;
- learn new technologies;

- identify appropriate pedagogical approaches for integrating those technologies into his or her class; and
- reflect on his or her experience through the process, including reflections on the differences in instruction, student responses, etc. between the two sections of their courses.

The researcher kept a journal of each meeting, tracking conversations between the researcher and participants, issues or successes that arose during the implementation of the program, and researcher reflections throughout the program.

Collaborative site. A collaborative website was created by the researcher as a repository for information collected during the iCAT program. The site was shared with each of the four instructors and included a list of the educational technologies and accompanying resources used during the program, an individual meeting log for each instructor, and a reflection journal for each instructor.

Choosing technologies. To secure buy-in, it was important to limit the amount of extra work required of the instructors. They were encouraged to keep the non-iCAT section as they had taught it in previous semesters. The iCAT section included technologies that they had not used in previous semesters. Therefore, the technologies chosen to be included in the iCAT program were those that the instructors were not currently using in their courses. For example, many of the instructors already used Microsoft Office™, Google Docs, the Internet as a learning tool, and interactive whiteboards. Thus, topics other than those were selected to serve as the ‘intervention’ instructional areas.

To justify the technology choices, the researcher analyzed the pilot questionnaire data to determine the amount of technology that students were seeing modeled and the amount of hands-on interaction they had with each technology during the graduate program. Table 9 displays the mean scores for the pilot study data for various types of technology; the highest ratings were for Microsoft Office™ and the Internet as a learning tool.

Table 9

Mean Scores for Frequency of Modeling and Hands-on Interaction in Graduate Program

Technology	Modeled	Hands-on Interaction
Microsoft Office™	2.21	2.50
Internet as Learning Tool	2.27	2.54
Google Docs	1.75	1.92
Classroom Response Systems	0.76	0.62
Google Earth	0.38	0.37
Interactive Whiteboards	0.51	0.48
Video Conferencing	0.45	0.39
Screencasting	0.82	0.81
Google Sites	1.38	1.28
Wikis	0.55	0.47
Blogs	0.66	0.55
Podcasts	0.44	0.36
Glogs	0.64	0.55
Social Networking	0.61	0.60

*Scores on a 0 (low) – 3 (high) scale

Further investigation of the pilot study data showed that students have had the most confidence using Microsoft Office™, the Internet as a learning tool, Google Docs, and social networking sites. In a similar way, the mean scores for frequency of integration were the highest for Microsoft Office™, the Internet, and interactive whiteboards. Table 10 displays the mean score for pilot study data for both confidence and integration frequency as reported by the students.

Table 10

Mean Scores for Confidence and Frequency of Integration for Educational Technologies

Technology	Confidence Using	Integration Frequency
Microsoft Office™	4.14	3.76
Internet as Learning Tool	4.29	3.36
Google Docs	3.22	1.37
Classroom Response Systems	2.08	0.96
Google Earth	2.72	1.03
Interactive Whiteboards	2.66	2.77
Video Conferencing	2.97	0.65
Screencasting	1.80	0.83
Google Sites	2.34	0.92
Wikis	1.85	0.61
Blogs	2.44	0.61
Podcasts	1.81	0.42
Interactive posters	1.25	0.31
Social Networking	4.17	0.97

*Scores based on a 0 (low) to 5 (high) scale

The results from Tables 9 and 10 helped eliminate Microsoft Office™, the Internet as a learning tool, Google Docs, and Interactive whiteboards from the iCAT program because of the current comfort level and amount of exposure to these technologies. Additional technologies were eliminated from the iCAT program because of accessibility issues at the participating schools. For example, many of the school districts in the state blocked social networking and file sharing sites and have restrictions on bandwidth. Therefore, Google Docs, Google Sites, Google Earth, video conferencing, wikis, blogs, interactive poster boards, and social networking sites were not included in the iCAT program.

The remaining technologies considered for the iCAT program were classroom response systems and screencasts. Classroom response systems were accessible to all InMAC instructors and students. A subscription to PollEverywhere.com was purchased through the use of the student technology fee associated with their tuition. The subscription allowed participants to respond to multiple choice and open-ended questions through the use of cell phones and computers. Screencast software, called JING, was accessible through a free download from Techsmith - http://www.techsmith.com/jing.html.

In addition to these two technologies, iPads were added to the list because each Teach for America student in the graduate program was provided with a refurbished first-generation iPad; this meant that they were now accessible to all instructors and students in the study. Because iPads were available, Podcasts were added to the iCAT program because InMAC students could easily download and save educational Podcasts to their iPads so that their students could access them at school.

Technologies. As mentioned previously, each instructor agreed to integrate a number of technologies into one section of a course and to refrain from integrating those technologies into the other section of the course. In some instances, the instructors had already been integrating several different technologies into their current courses (e.g. Google Docs, Internet as a learning tool). In an effort to minimize the extra work required by the volunteer instructors, they were allowed to continue to use those technologies in both sections of their courses. However, they also integrated the four new technologies into the iCAT sections, but not into the control section. For the iCAT program, instructors modeled and provided hands-on opportunities for students to use iPads, Poll Everywhere, screencasts, and Podcasts. Table 11 displays the technologies and how the instructors might use them with their students in their iCAT sections. The instructors completed a reflection log (Appendix L) that described the technology (or technologies) that they modeled in their class and those with which the students were able to interact each week.

Table 11

iCAT Program Technologies

Technology	Rationale	How InMAC instructors might use technology	How InMAC participants might use technology
iPads	All InMAC students have a first generation iPad. iPads and other mobile technologies are becoming more accessible to schools.	Instructor shared several educational iPad apps related to the course they are teaching.	InMAC participants downloaded iPad apps related to their teaching and make the app available to students on their iPads.
Poll Everywhere	Free polling software that allows students to answer multiple choice and open-ended questions using computers or cell phones without having to purchase costly equipment.	Instructors used Poll Everywhere software to check for understanding of weekly assignments and/or class lectures.	InMAC participants used Poll Everywhere software when presenting in-class assignments to their peers.
Screencasts	Free software that allows anyone to create a screencast video that can be shared with others.	Instructors created a screencast for an activity that they want their students to complete.	InMAC participants created a screencast as an aid to assist their students, parents, or colleagues.
Podcasts	Free audio and video files that can be used for educational purposes.	Instructors had students search podcasts using a variety of sites (iTunes, Podcastalley.com, etc.) via their iPads.	InMAC participants chose a Podcast that they could use in their classrooms. Students shared their choice and rationale with their peers. Students made the Podcast available to students on their iPads.

Timeline. As previously mentioned, the researcher and instructors met between seven and thirteen times throughout the semester in one-on-one and group meetings. The meetings varied from face-to-face interactions, synchronous webinars and videoconferences, and asynchronous screencasts and online discussions. The researcher used Google Docs to track instructors' meeting dates and the topics covered (Appendix K). Likewise, instructors reflected on their weekly teaching experiences using a Google Form (Appendix L) created by the researcher. Once the form was submitted, the data were automatically sent to a password-protected spreadsheet stored in the researcher's university account. The researcher kept confidential informal field notes using Evernote™.

In an effort to more easily track information and online discussions through the professional learning community, the researcher created a website (https://sites.google.com/a/asu.edu/icat-program/home) where instructors could go to view information related specifically to their course, participate in the online discussions, and view resources posted by the researcher. Each instructor had his or her own page linked to the website to access information related to his or her work with the researcher, including his or her individual meeting log and reflection notes. Appendix J shows a screenshot of the website layout.

The iCAT program used the TPACK model as a guide for the professional development program. The collaboration between the researcher and the instructors allowed for each component of TPACK to be addressed. The instructors were teaching graduate level courses in their content area so it was apparent that they had a strong background on the CK component. The researcher was a former educational technology specialist and a current instructor who taught educational technology courses and therefore had expertise in the TK component. The instructors and researcher were veteran teachers who used a wide range of pedagogical approaches to teach their courses. This dual-expertise allowed the instructors and the researcher to contribute to the PK of the professional development program.

Data Analysis

This mixed methods study included both quantitative and qualitative methods of data analysis. A concurrent triangulation approach allowed for the researcher to collect both quantitative and qualitative data concurrently and triangulate the data to determine whether there was convergence, differences, or some combination (Creswell, 2007; Jick, 1979).

Quantitative data. With respect to quantitative data, data from the pre- and post-intervention questionnaire was analyzed using a repeated measures analyses of variance (RM ANOVA) to determine whether there were differences for (a) confidence in using technology in everyday life, (b) self efficacy for technology integration, (c) attitudes toward technology integration, and (d) perceptions about utilization of technology integration in the classroom between the intervention and control groups. Additionally, separate step-wise regression procedures were conducted to determine whether (a) group effects, (b) amount of modeling, and (c) hands-on interaction within the graduate course would predict confidence, self-efficacy, attitude, and utilization of educational technology.

Qualitative data. With respect to qualitative data, the student data consisted of focus group interviews that were conducted near the conclusion of the intervention. Each focus group consisted of 5 to 12 participants. Students were asked to volunteer in one of three different focus group interviews (two for the treatment group and one for the control group). Those who volunteered to participate were categorized as having a high, medium, or low efficacy based on their responses to the pre-intervention questionnaire. The interviews were video recorded by the interviewer and then transcribed by a professional transcription service following the interview.

Several kinds of data were collected from the instructors and analyzed to check for the fidelity of the intervention. These included: (a) instructors' reflection logs, (b) informal field notes of observations, and (c) the researcher's journal.

Each qualitative data source was inductively analyzed and given initial descriptive codes. These codes were later assembled into categories, themes, and patterns that emerged from the data collected throughout the intervention (Patton, 1990). According to Miles and Huberman (1994), codes become efficient data-labeling and data-retrieval devices that make data analysis more efficient.

Collecting multiple sources of data adds significant opportunities for broad analysis (Yin, 2003). Additionally, questionnaire data alone has been shown to be less reliable (Simmons et al., 1999) and it has not always been considered the most effective measure of determining technology integration (Willis, Thompson, & Sadera, 1999).

Chapter 4

RESULTS

The first three chapters of this dissertation provided information about defining the research problem, the relevant literature on the topic, the methodology used during the implementation of the study, and the subsequent data analysis. The purpose of this chapter is to present the findings from both quantitative and qualitative instruments in an effort to answer the study's research questions:

1. How and to what extent were there differences in confidence, self-efficacy, attitude, and utilization of educational technology for in-service teachers who:
    a. completed two, three-credit hour graduate courses where educational technologies were integrated throughout both courses versus those who completed two, three-credit hour graduate courses where educational technologies were not integrated throughout both courses; and
    b. completed two, three-credit hour graduate courses and had already completed a stand-alone educational technology course (EED 531 – Teaching with Educational Technology) during their graduate program?
2. How and to what extent were confidence, self-efficacy, attitude, and utilization of educational technology predicted from modeling and hands-

on exposure that in-service teachers experienced during a graduate course(s)?

The purpose of this concurrent mixed methods study was to examine in-service teachers' views of educational technology use in the classroom. The participants in this study were in-service teachers, who were enrolled in a graduate program, and their instructors at a large urban university in the southwestern United States. A professional development program was implemented with the instructors to increase the instances of technology integration into these graduate courses. Entitled *Integrating Content and Technology* or iCAT, the professional development program provided learning opportunities on a variety of educational technologies.

A total of four instructors from the graduate program participated in the study. The instructors each taught two sections of the same course. Students from one of their sections were assigned to the treatment group and those from the other section were assigned to the control group. The instructors participated in the iCAT professional development program, led by the researcher, over the course of the Spring 2012 semester. This professional development program consisted of one-on-one and group sessions, during which information on integrating technology into the course was provided, and the researcher conducted observations. In addition, the researcher and instructors communicated frequently via email and text messages. For example, the researcher sent a reminder email each Wednesday to prompt the instructor to complete the reflection log. Table 12 displays various types of interactions that occurred between the researcher and instructors throughout the iCAT program. As the program progressed, it was apparent that the instructors needed different amounts of attention. For example, I met with Instructor 4 on thirteen different occasions because her skill set was lower than the other participating instructors. Therefore, she felt more comfortable meeting more frequently so that she could hear the technical jargon, practice using the iCAT technologies, and discuss appropriate implementation strategies on multiple occasions. By comparison, Instructor 3 came into the program with a higher skill set and more comfort regarding integrating technology into his course. Therefore, this instructor did not require as many one-on-one meetings to learn the technologies but instead, we met more often in the collaborative sessions to discuss ways of implementing the technologies with his students.

Table 12

Quantity and Type of Collaborative Interactions Between Researcher and Instructor

Instructor	Course Length*	One-on-One	Group	Observation	Total
Instructor 1	7	4	4	1	9
Instructor 2	7	3	4	1	8
Instructor 3	7	4	3	1	8
Instructor 4	13	6	5	2	13

*Courses are traditionally 8 and 15 weeks in length. The numbers in this table reflect the number of times the courses met due to a national holiday and spring recess.

During the program, the instructors were asked to implement four iCAT technologies, iPads, Podcasts, Poll Everywhere, and screencasting, into their iCAT treatment sections. Implementation included modeling the technology and providing students with the opportunity to interact with the iCAT technologies through hands-on activities and assignments. To ensure fidelity of implementation, the instructors were asked to complete a reflection log each week to describe how they used technologies during that week. Additionally, the students were asked during the focus group interviews to explain the technologies they had observed being modeled and those they had the opportunity to employ in a hands-on way during their course(s). As can be seen in Table 13 for Cohorts 1 and 3, the instructors modeled each of the technologies and the participants were also given the opportunity to interact with each technology through activities and assignments.

Table 13

Implementation of iCAT Technologies with Treatment Group

	iPads		Podcasts		Poll Everywhere		Screencasting	
	M	H	M	H	M	H	M	H
Cohort 1	X	X	X	X	X	X	X	X
Cohort 3	X	X	X	X	X	X	X	X

*Cohorts 1 and 3 each completed two 3-credit courses. Cohort 1 students were enrolled in courses taught by Instructors 1 and 2 while Cohort 3 students were enrolled in courses taught by Instructors 3 and 4.

Quantitative Data

Questionnaire response rate. Data used to answer the research questions was collected from the InMAC students who were enrolled in the InMAC graduate program described in Chapter 3. A total of 90 pre-intervention questionnaires and 82 post-intervention questionnaires were gathered online. The pre- and post-intervention questionnaire data yielded 74 matches. Of the 74 participant matches, 34 were from the iCAT treatment group and 40 were from the control group. Details with respect to these data are provided in Table 14. The additional responses from other students could not be included in the data analysis because there was no matching identification numbers between the pre- and post-intervention questionnaires. Therefore, those responses needed to be eliminated from consideration to conduct the appropriate data analyses.

Table 14

Intervention Participants

	iCAT	Control
Cohort 1	20	
Cohort 2		23
Cohort 3	14	
Cohort 4		17
Total	34	40

To analyze the quantitative data, pre- and post-intervention questionnaire data were exported from SurveyMonkey™ into a spreadsheet. The data were organized in Excel so that it could be easily imported into the Statistical Package for the Social Sciences (SPSS) program. These data were used to answer the following questions.

Research Question #1. How and to what extent were there differences in confidence, self-efficacy, attitude, and utilization of educational technology for in-service teachers who:

a. completed two, three-credit hour graduate courses where educational technologies were integrated throughout both courses versus those who completed two, three-credit hour graduate courses where educational technologies were not integrated throughout both courses; and
b. completed two, three-credit hour graduate courses and had already completed a stand-alone educational technology course (EED 531 – Teaching with Educational Technology) during their graduate program?

The confidence, integration, efficacy, and attitude data used to answer Research Question 1 (RQ1) were based on self-reports using a 6-point Likert scale described in Chapter 3. To answer the first part of RQ1, separate RM ANOVAs were conducted for each of the four dependent variables: confidence, integration, efficacy, and attitudes. The means are presented in Table 15, below. In order for the analysis to be significant, the p value had to be less than .05. The analyses were conducted in order to determine whether there were between-group effects for treatment, within-group effects for time, and interaction of Time x Treatment effects. Cohen (1988; cited in Olejnik & Algina, 2000) suggested $\eta 2$ values equal to or exceeding .01, .06, and .14 are considered to be small, medium, and large effect sizes, respectively, when proportion of variance accounted for is used as a measure of effect size.

To answer the second part of RQ1 about the influence of a previous technology course (EED 531) on participants' perceptions of their abilities in and attitudes to use technology, portions of the RM ANOVAs used to answer RQ1, part 1, were also used to answer this part of the RQ. The means are presented in Table 15.

Table 15

Means for Two, Three-Credit Hour Graduate Courses Pre- and Post-Intervention Scores

	iCAT Treatment Group				Control Group			
	No EED 531		Had EED 531		No EED 531		Had EED 531	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Confidence	3.54	3.73	3.67	4.50	3.46	3.49	4.06	4.03
Integration	1.81	1.89	2.19	2.50	1.84	1.97	2.45	2.53
Efficacy	3.08	3.47	3.04	4.54	3.22	3.50	3.62	4.00
Attitude	4.38	4.49	4.70	5.16	4.50	4.84	4.52	4.88

Pre=pre-intervention questionnaire, Post=post-intervention questionnaire, No EED 531=did not complete a stand-alone educational technology course, Had EED 531=did complete a stand-alone educational technology course.

Confidence in using technology in everyday life. Confidence in using technology in everyday life was analyzed using a RM ANOVA to compare the pre- and post-intervention confidence scores. One between-group outcome was relevant to answering the first part of the research question (differences in confidence scores for participants who completed two, three-credit hour graduate courses with or without the iCAT intervention). The analysis showed there was no significant between-group effect for the two groups, $F(1, 70) = 0.28, p < .59$; meaning that there was no difference in the means for confidence between the two groups.

Two between-group outcomes were relevant to answering the second part of the research question (differences in confidence for participants who completed two, three-credit hour graduate courses with or without the iCAT intervention and with or without having had EED 531). First, the analysis showed there was a significant between-group effect for EED 531, $F(1, 70) = 7.73$, $p < .01$. The effect size was .099, which is a medium effect size for a between-group design based on Cohen's criteria (Olejnik & Algina, 2000). From this finding, I can conclude those having EED 531 had greater confidence. Next, the Group x EED 531 interaction was not significant, $F(1, 70) = 0.11$, $p < .74$.

With respect to the within-group effects, two outcomes were relevant to answering the first part of the research question. First, the effect for time of measurement was significant, $F(1, 70) = 9.87$, $p < .01$. The effect size was partial $\eta^2 = .124$, which is a medium effect size for a within-group design based on Cohen's criteria. From this finding, I can conclude there was a difference between the pre- and post-intervention mean scores for confidence. Next, the within-group interaction of Time x Group was also significant, $F(1, 70) = 9.94$, $p < .01$. The effect size was partial $\eta^2 = .124$, which is a medium effect size for a within-group design based on Cohen's criteria (Olejnik & Algina, 2000). This finding showed that the iCAT treatment group's confidence scores increased at a faster rate than the control group over the course of the study.

Two additional within-group outcomes were relevant to answering the second part of the research question. First, the effect of Time x EED 531 interaction was not significant, $F(1, 70) = 3.35$, $p < .07$. By comparison, the Time x iCAT x EED 531 interaction effect was significant, $F(1, 70) = 4.58$, $p < .04$. The effect size was partial $\eta^2 = .061$, which is a medium effect size for a within-group design based on Cohen's criteria (Olejnik & Algina, 2000). This interaction indicated that scores for the participants in the iCAT treatment group who also had completed a previous technology course increased at a greater rate from pre- to post-intervention than their counterparts from the other three groups. The interaction can be better understood by considering that those who had the iCAT treatment in combination with having had EED 531 gained 0.87 points from pre- to post-test assessment, which was much greater than the gains attained by the other three groups, which gained from -0.03 to 0.19 points. See Table 16 below.

Table 16

Pre- and Post-Intervention Means for Confidence Scores by Group, EED 531, and Time

		Pre	Post
Control Group	No EED 531	3.46	3.49
	Had EED 531	4.06	4.03
Treatment Group	No EED 531	3.54	3.73
	Had EED 531	3.67	4.50

Pre=pre-intervention questionnaire, Post=post-intervention questionnaire, No EED 531=did not complete a stand-alone educational technology course, Had EED 531=did complete a stand-alone educational technology course.

Integrating technology into the classroom. Perceptions about the ability to integrate technology into the classroom were analyzed using a RM ANOVA to compare the pre- and post-intervention technology integration scores. One between-group outcome was relevant to answering the first part of the research question (differences in perception of technology integration for participants who completed two, three-credit hour graduate courses with or without the iCAT intervention). The analysis showed there was no significant between-group effect for the two groups, $F(1, 70) = 0.40$, $p < .54$.

Two between-group outcomes were relevant to answering the second part of the research question (differences in perception of technology integration for participants who completed two, three-credit hour graduate courses with or without the iCAT intervention and with or without having had EED 531). First, the analysis indicated there was a significant between-group effect for EED 531, $F(1, 70) = 11.54$, $p < .001$. The effect size was .141, which is large effect size for a between-group effect (Olejnik & Algina, 2000). From this finding, I can conclude those having EED 531 had higher perceived integration scores. The iCAT x EED 531 interaction was not significant, $F(1, 70) = 0.08$, $p < .78$.

With respect to the within-group effects, two outcomes were relevant to answering the first part of the research question. First, the effect for time of measurement was not significant, $F(1, 70) = 2.76$, $p < .12$ Next, the within-group interaction of Time x Group was also not significant, $F(1, 70) = 0.24$, $p < .63$.

Two additional within-group outcomes were relevant to answering the second part of the research question. First, the effect of Time x EED 531 interaction was not significant, $F(1, 70) = 0.26$, $p < .62$. Moreover, the Time x iCAT x EED 531 interaction effect was not significant, $F(1, 70) = 0.62$, $p < .44$.

Efficacy for using educational technology. Efficacy for using technology in the classroom was analyzed using RM ANOVA to assess the pre- and post-intervention efficacy scores. One between-group outcome was relevant to answering the first part of the research question (differences in efficacy for using educational technology for participants who completed two, three-credit hour graduate courses with or without the iCAT intervention). The analysis showed there was no significant between-group effect for the two groups, $F(1, 70) = 0.07$, $p < .79$,

Two between-group outcomes were relevant to answering the second part of the research question (differences in efficacy for using educational technology for participants who completed two, three-credit hour graduate courses with or without the iCAT intervention and with or without having had EED 531). First, the analysis showed there was a significant between-group effect for EED 531, $F(1, 70) = 7.73$, $p < .01$. The effect size was .099, which is medium effect size for a between-group effect. From this finding, I can conclude those having EED 531 had greater efficacy. Next, the iCAT x EED 531 interaction was not significant, $F(1, 70) = 0.04$, $p < .86$.

With respect to the within-group effects, two outcomes were relevant to answering the first part of the question. First, the effect for time of measurement was significant, $F(1, 70) = 38.94$, $p < .001$. The effect size was partial $\eta^2 = .356$, which is a large effect size for a within-group design based on Cohen's criteria (Olejnik & Algina, 2000). This finding showed the mean scores at the post-intervention assessment were significantly greater than the pre-intervention scores. Next, the within-group interaction of Time x Group was also significant, $F(1, 70) = 9.28$, $p < .01$. The effect size was partial $\eta^2 = .117$, which is a medium effect size for a within-group design based on Cohen's criteria. This finding showed that the iCAT treatment group's efficacy scores increased at a faster rate than the control group over the course of the study.

Two additional within-group outcomes were relevant to answering the second part of the research question. First, the effect of Time x EED 531 interaction was significant, $F(1, 70) = 8.80$, $p < .01$. The effect size was $\eta^2 = .112$, which is a medium effect size for a within-group effect. This result reflects the difference in changes in scores from pre- to post-intervention assessment that favored those who had EED 531. Moreover, the Time x iCAT x EED 531 interaction effect was significant, $F(1, 70) = 6.09$, $p < .02$; with partial $\eta^2 = .080$, a medium effect size for a within-group effect. This interaction indicated that scores for the participants in the iCAT treatment group that had also completed a previous technology course increased at a greater rate from pre- to post-intervention than their counterparts from the other three groups. The interaction can be better understood by considering that those who had the iCAT treatment in combination with having had EED 531 gained 1.50 points from pre- to post-test assessment, which was much greater than the gains attained by the other three groups, which gained from 0.28 to 0.39 points. See Table 17 below.

Table 17

Pre- and Post-Intervention Means for Efficacy Scores by Group, EED 531, and Time

		Pre	Post
Control Group	No EED 531	3.22	3.50
	Had EED 531	3.62	4.00
Treatment Group	No EED 531	3.08	3.47
	Had EED 531	3.04	4.54

Pre=pre-intervention questionnaire, Post=post-intervention questionnaire, No EED 531=did not complete a stand-alone educational technology course, Had EED 531=did complete a stand-alone educational technology course.

Attitude toward using educational technology. Attitude toward using technology in the classroom was analyzed using a RM ANOVA to assess the pre- and post-intervention scores for this variable. One between-group outcome was relevant to answering the first part of the research question (differences in attitude toward educational technology for participants who completed two, three-credit hour graduate courses with or without the iCAT intervention). The analysis showed there was no significant between-group effect for the two groups, $F(1, 70) = 0.00$, $p < 1.00$.

Two between-group outcomes were relevant to answering the second part of the research question (differences in attitude toward educational technology for participants who completed two, three-credit hour graduate courses with or without the iCAT intervention and with or without having had EED 531). First, the analysis indicated there was no significant between-group effect for EED 531,

$F(1, 70) = 1.77$, $p < .19$. Further, the iCAT x EED 531 interaction was not significant, $F(1, 70) = 1.38$, $p < .24$.

With respect to the within-group effects, two outcomes were relevant to answering the first part of the research question. First, the effect for Time of measurement was significant, $F(1, 70) = 13.53$, $p < .001$. The effect size was partial $\eta^2 = .162$, which is a large effect size for a within-group design based on Cohen's criteria (Olejnik & Algina, 2000). This finding showed the mean scores at the post-intervention assessment were significantly greater than the pre-intervention scores for attitudes toward using technology. By comparison, the within-group interaction of Time x Group was not significant, $F(1, 70) = 0.14$, $p < .72$.

Two additional within-group outcomes were relevant to answering the second part of the research question. First, the effect of Time x EED 531 interaction was not significant, $F(1, 70) = 1.92$, $p < .30$. Moreover, the Time x iCAT x EED 531 interaction effect was not significant, $F(1, 70) = 0.89$, $p < .36$.

Summary. Taken together, for the four variables there were no significant between-group effects, nor were there any significant within-group effects for perceptions about integrating technology in the classroom. However, the evidence showed that confidence, efficacy, and attitude scores for both groups increased moderately to substantially from the beginning to the end of the study. Upon closer analysis, the within-group interaction between Time x Group showed that the treatment group participants' scores for confidence and efficacy increased at a faster rate than did the control group participants' scores.

With respect to the previous technology course influencing participants' scores, the evidence is mixed. For attitudes toward using technology in the classroom, none of the statistical tests were significant. For perceptions about integrating technology into the classroom, only the between-group effect for EED 531 was significant. By comparison, for confidence and efficacy for using educational technology in the classroom, the effect of having a previous course was significant. Moreover, for the efficacy variable, there was a within-group interaction of Time x EED 531. These results showed that those with a previous course scored higher on efficacy. Lastly, for the confidence and efficacy variables, there was a three-way within-group interaction of Time x Group x EED 531. These three-way interactions indicated that scores for the participants in the iCAT treatment group who also had completed a previous technology course increased at a greater rate from pre- to post-intervention than scores for their counterparts from the other three groups.

Research Question #2: How and to what extent were confidence, self-efficacy, attitude, and utilization of educational technology predicted from modeling and hands-on exposure that in-service teachers experienced during a graduate course(s)?

The data for modeling and hands-on activities used to answer Research Question #2 (RQ2) were based on self-reports using a 4-point Likert scale described in Chapter 3. A step-wise regression procedure using SPSS was proposed to analyze the data for RQ2. In this analysis, the data for dependent variables—confidence, integration, efficacy, and attitude—were to be individually regressed on the independent variable for group and the post-intervention questionnaire data for hands-on use and modeling scores to determine whether observing and/or engaging with the educational technologies used in this study were useful predictors of confidence, integration, efficacy, and attitude. In multiple regression analyses, R^2 values of .02, .13, and .26 are associated with small, medium, and large effect sizes, respectively (Cohen, 1988). On this questionnaire, modeling is defined as the course instructor demonstrating the use of the various technologies during the course, either during in-class lectures or outside homework. For example, an instructor may have used a screencast to show the participants how to complete an assignment. Likewise, hands-on use is defined as the participants having the opportunity to use the various technologies through in-class activities or assignments. For example, the participants in one class were required to create a screencast describing how to use a virtual manipulative. Prior to performing the step-wise regression procedure, the correlation between instances of modeling and hands-on interaction was investigated. This analysis showed that the two were highly correlated, $r = .85$, and therefore, only hands-on interaction with the technologies was used in conjunction with treatment group to predict confidence, integration, efficacy, and attitude.

A step-wise regression analysis was performed to determine whether treatment group and hands-on interaction with various technologies in a graduate course could predict confidence in using technology in everyday life. At step 1, the analysis showed that there was no significant effect for groups, $F(1, 72) =$

2.29, $p < .14$. At step 2, the analysis showed that there was a significant effect for the amount of hands-on interaction in which participants engaged and their confidence scores, $F(2, 71) = 7.74$, $p < .001$. After accounting for the variability of being in one of the groups, the hands-on scores for confidence accounted for approximately 17.9% of the variation, which indicates a medium effect size (Cohen, 1988).

A step-wise regression analysis was performed to determine whether treatment group and hands-on interaction with various technologies in a graduate course could predict the integration of technology in the classroom. At step 1, the analysis showed that there was no significant effect for groups, $F(1, 72) = 0.11$, $p < .75$. At step 2, the analysis showed that there was a significant effect for the amount of hands-on interaction in which participants engaged and their integration scores, $F(2, 71) = 20.81$, $p < .001$. After accounting for the variability of being in one of the groups, the hands-on scores for integration accounted for approximately 37.0% of the variation, which indicates a large effect size.

A step-wise regression analysis was performed to determine whether treatment group and hands-on interaction with various technologies in a graduate course could predict the participant's self-efficacy for using technology in the classroom. At step 1, the analysis showed that there was no significant effect for groups, $F(1, 72) = 0.83$, $p < .37$. At step 2, the analysis showed that there was a significant effect for the amount of hands-on interaction in which participants engaged and their self-efficacy scores, $F(2, 71) = 4.84$, $p < .02$. After accounting for the variability of being in one of the groups, the hands-on scores for self-efficacy accounted for approximately 12% of the variation, which indicates a medium effect size.

A step-wise regression analysis was performed to determine whether treatment group and hands-on interaction with various technologies in a graduate course could predict the participant's attitude toward using technology in the classroom. At step 1, the analysis showed that there was no significant effect for groups, $F(1, 72) = 0.18$, $p < .68$. At step 2, the analysis showed that there was also no significant effect for the amount of hands-on interaction in which participants engaged and their attitude scores, $F(2, 71) = 2.62$, $p < .08$.

Summary. Taken together, at step 1 of the regression analysis, the grouping variable could not help predict any of the four variables. However, at step 2 of the regression analysis, the likelihood that the hands-on intervention could help predict confidence in using technology in everyday life, perceptions about integrating technology in the classroom, and efficacy for using educational technology were all significant. There was a moderate amount of variance that could be explained by the intervention for the confidence and efficacy variables, 17.9% and 12%, respectively. Similarly, there was a large amount of variance, 37% that could be explained by the amount of class-related, hands-on experience for the integration variable.

Qualitative Data

Three types of qualitative data were collected: (a) transcriptions from focus group interviews, (b) instructor reflection logs, and (c) descriptive field notes. All of these data were imported into HyperRESEARCH™, a program that enables the user to code and conduct analyses of data. Prior to importing the focus group interviews into the program, the audio was transcribed using GRM Transcription services (http://www.gmrtranscription.com/).

The descriptive field notes included dialogue from various meetings, emails, and classroom observations of the six participating instructors conducted by the researcher. The instructors completed their reflection logs at the end of each week during the study. In total, 56 reflection logs were submitted, resulting in 37 pages of notes. Focus group interviews with participants from iCAT and control groups constituted the main portion of the qualitative data. In total, there were two iCAT focus group interviews totaling 21 pages of transcribed notes and one control focus group interview totaling 13 pages of transcribed notes.

Each type of qualitative data was inductively analyzed and given initial descriptive codes. These codes were later assembled into categories, themes, and patterns that emerged from the data collected throughout the intervention (Patton, 1990). According to Miles and Huberman (1994), codes become efficient data-labeling and data-retrieval devices that make data analysis more efficient. The results from these data are presented in the following sections. However, the complementarity of these results to the quantitative data, along with recommendations and conclusions, are presented in Chapter 5.

Focus group interviews. Each of three focus group interviews lasted between 20-30 minutes: two iCAT group interviews and one control group interview. The iCAT interviews included 13 total participants and the control group interview included 10 participants. The focus group interviews consisted of six open-ended questions (see Appendix H) that provided data to help answer the research questions for this study.

The focus group interview data were analyzed using the constant comparative method in which initial codes are collected into larger categories and then into related groups from which themes were developed (Strauss & Corbin, 1998). During the analysis of the focus group data, three themes emerged. The themes were (a) instructor modeling and student participant interactions with technology, (b) attitudes and beliefs, and (c) barriers.

The organization of this study provided the opportunity to obtain reactions from a treatment group—those who received modeling and hands-on interaction with the iCAT technologies; and the control group—those who were not exposed to the same technologies. The upcoming sections will provide insight into the participants' experience throughout the iCAT program, the barriers they face while attempting to integrate technology into their classroom, and their attitudes and beliefs toward educational technology.

Modeling and hands-on interaction. The first theme, modeling and hands-on interaction, included two categories: (a) modeling and (b) hands-on use, which were identified using the codes in Table 18.

Table 18

Categories and Codes for the Theme Modeling and Hands-On Interaction

Theme	Modeling and Hands-on Interaction	
Categories	Modeling	Hands-On Use
Codes	Instructor modeling of iCAT technologies Instructor modeling of other technologies	Participant hands-on interaction with iCAT technologies Participant hands-on interaction with other technologies Participant interaction on iCAT assignments Participant interaction on other assignments

For this theme, the codes were developed through the responses from the iCAT treatment group and the control group to question #2 (*What technologies did you see modeled in your class this semester? How often? How were they used?*) and question #3 (*What technologies did you have hands-on experience using in your class this semester? How often? How were they used?*). In the upcoming Instructor Log portion of the results, the data from logs were analyzed to determine whether these data confirmed or disconfirmed the data from focus groups.

As mentioned in Chapter 3, there were four main technologies that were part of the iCAT intervention program: iPads, polling software, Podcasts, and screencasts. The instructors were asked to implement those technologies in the treatment group and omit them in the control group classes. When asked what technologies they saw modeled in their classes, the participants in the treatment group interviews mentioned that they saw all four of the iCAT program technologies modeled and had hands-on engagements with all four technologies as well. In addition to the four iCAT technologies, participants either observed a variety of other technologies that were modeled for them or they had the opportunity to engage with them during hands-on activities. These technologies included Google Docs, Microsoft Office™ products, Prezi™ and other presentation tools, virtual manipulatives, webinars, social networking sites, Blogs, and Web site development tools. The control group participants also mentioned that they saw a number of these same technologies modeled including Google Docs, Microsoft Office™ products, Prezi™ and had a chance to interact with them. However, they did not mention that they were not exposed to the iCAT technologies.

With respect to the iCAT technologies being used with the treatment group, the participants were asked how their instructors modeled the use of iCAT technologies (iPads, polling software, Podcasts, and screencasts) during their graduate course. A few comments regarding the iCAT technologies they observed being modeled included:

- “All of our presentations just about, the instructor used a poll and we had to answer it.”
- “We had a guest speaker present on how she had her kids make Podcasts.”
- “The instructor modeled JING to show us how to do our virtual manipulative assignment.”

Similarly, many of the instructors used non-iCAT technologies throughout the courses. A few comments regarding other non-iCAT technologies being modeled in both groups included:

- “We saw a lot of different websites that included math manipulatives.”
- “Social networking type things.”
- “Edmodo”
- “We saw [instructor] use the Smartboard. He used an interactive whiteboard lesson.”

Along with seeing the iCAT technologies modeled by their instructors, the iCAT participants responded that they were able to interact with iCAT technologies during their course activities and assignments. A few examples included:

- “We had to include a poll question in our presentations.”
- “We also were working with our iPads a lot just trying to find applications that would be relevant to the content that we were teaching in our classrooms.”
- “We [had group discussions] a lot about Podcasts.”
- “We had to find Podcasts.”
- “We created a screencast on virtual manipulatives.”
- “We were working with our iPads a lot just trying to find applications that would be relevant to the content that we’re teaching in our classrooms.”

Likewise, the participants in both groups also responded that they had the opportunity to interact with a variety of other non-iCAT technologies. A few examples of assignments and activities that allowed participants to have hands-on interactions with non-iCAT technologies included:

- "We had to do a Google Presentation."
- "Weebly website and Glogster."
- "We used Twitter one day in a presentation."
- "In [instructor's] class, we used a lot of illuminations, just a virtual manipulative site."

As is apparent from the participants' comments provided above, the instructors modeled the iCAT technologies throughout the course. Likewise, the participants in the control group had the opportunity to experience hands-on interaction with the non-iCAT technologies on different occasions.

Attitudes and beliefs. The second theme, attitudes and beliefs, included two categories: (a) beliefs about technology and (b) attitudes toward technology, which were identified using the codes in Table 19.

Table 19

Categories and Codes for the Theme Attitudes and Beliefs

Theme	Attitudes and Beliefs	
Categories	Beliefs	Attitudes
Codes	New vs. old thinking New ways of implementing Meaningful ways of implementing Prepare students Productivity	Changes in attitude Their K-12 students understand how to use technology Their K-12 students are excited/engaged when using technology

For this theme, the codes were gathered through the responses from the iCAT treatment group and the control group to question #5 (*Have your beliefs that you can integrate technology into your classroom instruction changed over the semester due to this course or the combination of two courses?*) and question #6 (*Has your attitude toward integrating various educational technologies changed since the start of this semester due to this course or the combination of two courses?*).

Overall, there were consistencies in responses within the two groups. With respect to beliefs about educational technology, both groups commented that technology should not be included in the classroom just because it was a current trend. Instead, both groups felt that incorporating technology should be integrated into instruction and learning in meaningful and thoughtful ways.

During the focus group interviews, the iCAT treatment group mentioned that they had learned many new ways of implementing new technologies, in part due to the exposure to the various technologies integrated into their graduate course. One participant stated, "I had no idea about Podcasts and screencasts. It definitely changed my [view] on how I could use it in the classroom."

With respect to attitudes toward technology, again, there were several consistencies in the responses across the two groups, albeit at different rates. Both groups described how their attitudes, for the most part, were positive and had increased. Although the terminology used by the participants varied, responses presented below were representative of the iCAT group:

- "My attitude has been pretty positive towards technology."
- "Getting into my classroom and realizing how much easier and more engaging it is to use [technologies] has definitely changed my attitude to an extent."
- "At first, my thought of using laptops and using different things, I thought it would be a distractor to my students and they would probably just think they were playing with the laptop instead of learning. But, after using it throughout the whole year [*sic*] actually saw that they were more engaged [in the] behavior and behavior management was great. I'm just ready for next year and trying to implement the whole thing again."
- "I feel like I have definitely become more comfortable with the technologies that were out there because I didn't really even know what a Podcast was."

By comparison, control group participants also mentioned that their attitude had either stayed the same or increased during their courses. This may have to do with the fact that they were still exposed to different technologies during their graduate course, but not the four iCAT technologies to which the treatment group was exposed. A few examples from the control group include:

- "I think my attitude has changed. I think basically just being exposed to the different ideas has made me more likely to try them."
- "I think I got a lot of excellent resources."
- "I would love to integrate all of these different things."

Overall, a majority of both groups held positive beliefs and attitudes toward the integration of educational technology. They felt that integrating technology into their classrooms can increase engagement and get students excited about learning. Additionally, they saw the need to prepare their students to use technology so students have the productivity skills necessary to join the work force.

***Barriers*.** The final theme, barriers, included three categories: (a) access, (b) professional development, and (c) classroom management, which were identified using the codes in Table 20.

Table 20

Categories and Codes for the Theme Barriers

Theme	Barriers		
Categories	Access	Professional Development	Classroom Management
Codes	Lack of access District policies Frustration with access Poor equipment Scheduling difficulties Student access Technical support	Efficacy Lack of professional development Reduces instructional time	Concerns students will damage equipment Classroom management of equipment Other professional responsibilities Student mobility

For this theme, the codes were derived from the responses of the iCAT treatment group and the control group to question #4 (*What educational* *technologies do you use with your students? How do you integrate those technologies with your students?*), question #5 (*Have your beliefs that you can integrate technology into your classroom instruction changed over the semester due to this course or the combination of two courses?*), question #6 (*Has your attitude toward integrating various educational technologies changed since the start of this semester due to this course or the combination of two courses?*) and question #7 (*Has your integration of various educational technologies changed since the start of this semester due to this course or the combination of two courses?*).

There were several barriers that were mentioned throughout the focus group interviews by both treatment and control groups that influenced the amount of technology the participants ultimately used with their students.

Access to technology as a barrier. Student and teacher access was universally mentioned as a barrier to using technology in the classroom. The participants consistently mentioned that they would gladly integrate technology with their students if only they had sufficient access to reliable equipment. Many of the participants mentioned that they had access to only one working computer in the classroom that was mainly used by the teacher. Comments included:

- "…and it would be cool if I could [integrate technology with my students] and I know my students would be more engaged, but we just don't have the technology to support that."
- "I do not integrate technology only [*sic*] because [of] the lack of resources."

Those participants who do have technology available to them cited frustration with poor and outdated equipment and inconsistent technical support as another reason for not integrating technology with their students. Examples of these types of barriers included:

- "I have a teacher computer and a Smartboard™. Sometimes it works; sometimes it doesn't. It's nice when everything is capable [*sic*], but then it doesn't work."
- "I have six kind of oldish [*sic*] computers that sometimes work [and] sometimes don't."
- "We haven't been able to do anything too complicated because they don't all have flash on the computers."
- "I put in tons of requests for someone to come out and look at [the broken technology] and it has never been looked at [*sic*]."

Strict district policies were frequently mentioned as another factor that inhibited technology use in the classroom. School districts often block teacher access to the district's wireless Internet service, as well as other valuable web-based tools such as online educational videos and Internet sites that include a social aspect. All of the participants in this study were given iPads at the beginning of the year (not related to this study) but because of district policy, they were not able to access the school's wireless Internet. A few examples participants gave regarding district policies as a barrier included:

- “I was so excited [about what] I learned and then I realized how many roadblocks there are in terms of getting that stuff that you need to make it accessible.”
- “I couldn’t install it on my school computer without the tech people. Once they installed it, [none of my documents] transferred.”
- “It’s frustrating because they don’t have a lot of availability at my school [because of] blocked websites…”
- “I use very little, honestly, just because our laptops have had issues with Deep Freeze. We pretty much don’t get past the Internet because everything you try and save is gone the next period.”

Many students have their own handheld devices now but district policies forbid them from using those devices during class time. One teacher mentioned, “I would do Poll Everywhere™ but I just haven’t because they’re not supposed to bring their cell phones out.” Another teacher agreed, stating, “If cell phones were allowed to be used in the classroom then I would use them.”

Professional development as a barrier. Professional development about new technologies was mentioned during the focus group interviews as another barrier. During one of the interviews, several of the participants commented that they had a brand new Smartboards™ in their classrooms. When asked if they had received professional development on how to use the technology, several of the participants said that they had yet to receive any help. A similar pattern emerged throughout the interviews. Participants received equipment such as document cameras, Smartboards™, projectors, and various other pieces of equipment without any instruction on how to use the equipment. Often, the equipment was either left unused or the participants had to take it upon themselves to learn how to use the equipment or have their students help them learn how to use it. A few comments that were echoed by many of the participants included:

- "We have technology available but there is nobody there training us on how to use it."
- "I just got a webcam and projector a couple weeks ago. I wasn't trained but I am figuring it out as I go along."
- "A month ago my kids started teaching me how to use it."

Although many of the participants said that they did not feel comfortable using technology in their classrooms because of the lack of professional development offered by their school districts, several said that their efficacy for technology improved by seeing technology modeled in the graduate course and then having the opportunity to interact with the technology. A few examples of improved self-efficacy because of the iCAT program included:

- "I think I am more willing to try stuff now. At first, I was overwhelmed with just being in the classroom. Now, I have been able to think about it and research it more. So, I feel more comfortable and confident trying to use them."
- "I feel more confident. If I had all the tools then I would definitely use it more. [The course] was really helpful to have them modeled in."
- "I feel like I have definitely become more comfortable with the technologies that are out there."

Classroom management issues as a barrier. In addition to the lack of student and teacher access to various educational technologies, the participants also mentioned classroom management issues, lack of time, and other professional responsibilities as reasons for their limited integration levels. A few participants mentioned that they were hesitant to allow students to use the equipment because they feared the students would damage it. One participant said:

> "I would really like to educate the kids on how to use the technology because I am still afraid of giving them all a laptop without being super explicit in what is required of them."

An area that was addressed by multiple participants was a general lack of understanding about how to manage a classroom while using technology. One participant mentioned that transitioning to a technology-based lesson would take too much time, ultimately reducing the amount of instructional time. She said, "I want to figure out how to get [the equipment] to the kids, how to get them back, how to get them taken care of, and get them used to using them so it's not this fiasco every time."

One participant, who had encountered the same issue, mentioned she had worked over the summer to develop procedures so that she was more at ease with allowing her students to use the technology. She stated, "Last year, I was terrified of them breaking something or messing something up. This year, I realized that if I put the procedures in place then they are going to be fine on their own."

The lack of professional development with respect to managing a classroom where educational technologies are used was also viewed as a barrier. This matter was related to issues of efficacy for the teachers who were using the technology. Two examples of this issue were:

- "I would personally love to implement more technology. I just don't feel comfortable even with the amount of training that I got at district."
- "I think it's the staff that is uncomfortable with [the technology] and that's why the kids don't use it more."

One final barrier mentioned was the grade level at which the participants were teaching. Although only one student mentioned this, I feel that the sentiment was probably shared among other participants. The lower the grade level at which the participant was teaching, the less likely he or she was to integrate technology into their classroom. Specifically, the student said:

> I don't know if this is the case with anybody else, but I teach kindergarten. I would say that this is as equally inhibiting as the fact that I have three computers for 35 kids. I think that if one of those factors were different then I could implement [technology] a lot more.

As mentioned in the previous theme, attitudes and beliefs about the integration of technology were generally positive. However, where participants were transferring these attitudes and beliefs from the college classroom to their own K-12 classrooms, it proved to be much more difficult. Barriers like district policies, inadequate equipment, and poor professional development seemed to be the biggest factors that inhibited participants in this study from integrating technology more frequently.

Instructor logs. Instructor logs were another source of data that helped support or complement the focus group interviews and quantitative data. Each week, the instructors completed an instructor reflection log that chronicled their participation in the iCAT program that week. The instructors wrote about how they modeled various technologies and how they supplied the participants with opportunities to interact with technologies through course activities and assignments. The instructors were also asked to describe any differences they may have noticed between the iCAT and control groups. Finally, they were given the opportunity to provide any additional comments or reflections about the program and how they would go about teaching with technology if they were given the opportunity to do it again.

Technologies modeled. Each instructor followed the iCAT program relatively closely. They incorporated the iCAT technologies with the iCAT treatment group while omitting those same technologies with their control group. Each instructor modeled a collection of technologies with their treatment groups including the iCAT technologies (iPads, polling software, Podcasts, and screencasts), Microsoft Office™, Youtube videos, Blackboard, interactive websites, and Google Educator Apps. In addition to the various software technologies, the instructors used a variety of hardware like interactive whiteboards, iPads, projectors, and document cameras. Similarly, the instructors used all of the same technologies, with the exception of the iCAT technologies, with their control groups. A few examples of how the instructors modeled iCAT technologies to the treatment group included:

- "I created and shared a screencast to show students how to navigate through a website in order to do an online assignment."
- "I modeled the use of Poll Everywhere to introduce the Basal Analysis/Critique activity."
- "I provided examples of literacy Podcasts and modeled searches for Podcasts to use to support literacy instruction."
- "I modeled the use of a screencast in my class. I suggested that students incorporate this technology as a tool for the Parent assignment."
- "I created a mini-module with links to free iPad education-related apps, articles, a Google site with iPad apps integrating the use of the revised Bloom's Taxonomy with technology-infused small groups."

In addition to the iCAT technologies, the instructors modeled a variety of non-iCAT technologies with both treatment and control groups. A few examples included:

- "I used Google Forms, Google Sites, PowerPoint, Blackboard and Youtube videos during class."
- "I presented course content in PowerPoint. I modeled and created a Google Doc."
- "I shared web-based materials that could be used in a math classroom. This was the assignment equivalent to the iPad app share from the [treatment] group."

- "I modeled how to navigate through my course Blackboard shell using my computer and classroom projector. I showed students the features on Blackboard along with an introduction using Google Presentation."

Engagement with technologies through hands-on activities. The second portion of the intervention was to have the participants interact with the iCAT technologies through hands-on activities and assignments provided by the instructor. A few examples of how the participants in the treatment group interacted with the iCAT technologies, as described by the instructors included:

- "Between class sessions, students will be searching for a free iPad app that could be used in a math classroom. They will be posting an app review and the link to the Blackboard discussion board. We will be discussing the apps in our next class meeting."
- "The students viewed the Podcast websites and examples shared by [the guest speaker]. They were then instructed to add Podcasting connections, linked to ADE Standards or Core Standards, as well as identify and describe ways in which they could use Podcasting in their classrooms."
- "Students needed to create screencasts for virtual manipulatives. They will then be reviewing at least three of their colleagues' screencasts and commenting on them using a Google form."

In addition to the iCAT technologies, the participants in both treatment and control groups were engaged with a variety of non-iCAT technologies. A few examples included:

- “Students shared web-based material for the mathematics classroom in class.”
- “The students created their own PowerPoint presentations with peers. They included Youtube videos to create engagement in the presentations.”
- “Students created Google docs for their case study assignment. They shared their docs with members of the professional learning community (PLC) group and the instructor.”
- “Students need to find web-based materials to share with the class. They will post the link to the material on the discussion board.”

Differences between the iCAT and control groups. The instructors were asked to reflect each week on the differences they may have noticed between the treatment and control groups. One instructor noticed how his treatment group participants were disappointed that they were going to miss a week of the class due to school district’s spring break. He stated:

> Students in this week’s class (treatment group) were very excited about the content of the class. Many of them will be out of town next week and they were really upset that they might miss some of the content. They even made arrangements to meet me at different times to get caught up on the content they missed.

Another instructor commented that she felt her participants in the treatment group performed better on one of the assignments. She noted: “I thought that the students in the [treatment] section had a deeper understanding of the manipulative assignment and how it was used compared to the students in the [control] section." The same instructor also noticed that her treatment participants initiated a technology-based discussion after a video was shown to the class. She commented:

> I showed a Youtube video of a teacher demonstrating a concept using virtual base ten blocks on the interactive whiteboard. When I showed the video to the [control] section, there were no comments about the technology being used. When I showed the video to the [treatment] section, there were questions and a mini-discussion on interactive whiteboards and some tools that come with them.

One instructor noticed that the time it took to get through a particular topic took twice as long with the control group as it did with the treatment group because he was able to model the use of screencasts. He logged: "Instruction time for my [control] class took twice the time when I used direct instruction. By having the screencast available, the number of follow-up questions was greatly reduced."

Several of the instructors mentioned that efficacy, engagement, and excitement seemed to be at a higher level in their treatment group section when compared to their control group section. A few examples of these kinds of comments included:

- "The [treatment] group seems more eager to add technology into their presentations."
- "The [treatment] group was very excited about the polls. It provided an engaging hook for the lesson."

- "Using Poll Everywhere opened up questions and discussions that I hadn't anticipated or experienced in previous classes."
- "My [treatment] group students seemed pretty excited about student-generated Podcasts."

One instructor noticed a stark difference in confidence between the two sections. She observed that her participants took more control of their assignments stating: "My [treatment] class took ownership of the book group assignment because they were managing their own sites."

Summary. There were clear differences in responses between participants in the two groups with respect to the amount of technology they saw modeled as well as the opportunity to engage with technology during their graduate course. The iCAT group was extremely excited to have the opportunity to see new ways of using technology and the ability to practice using those technologies during class. With respect to attitudes and beliefs, the groups demonstrated similar interests in employing technology, but differed in regard to appropriate ways to implement the use of technology.

Moreover, a common outcome across both groups was the barriers that teachers, especially those in economically challenged areas, face on a day-to-day basis. Both groups mentioned that they would be open to using new technologies with their students, but that it was frustrating, time-consuming, and easy to do the "norm" instead of fighting through the barriers. Likewise, both groups suggested they (a) had limited resources, (b) were restricted by stringent district policies as to what they could use with students, (c) received little to no professional development outside of their graduate program, and (d) were hindered by inadequate technical support.

Consistent with the student data, the instructors' logs complemented the student responses with their account of the intervention. The instructors integrated the iCAT technologies with the treatment group as outlined in the intervention. They noticed and subsequently commented on the differences between the two groups with respect to the participants' efficacy, performance, and attitudes toward the technologies observed in the different classes.

Chapter 5

DISCUSSION

The use of technology can affect "academic success and help prepare all learners for post-secondary education, careers, and life" (International Society for Technology in Education [ISTE], 2012, p. 1). However, even with the increasing availability of educational technology, many teachers report that they do not feel sufficiently prepared to use technology in their daily classroom instruction (National Education Association [NEA], 2008).

Although improving the integration of technology in K-12 instruction has become increasingly important in the United States, a key factor hindering the effective use of technology integration is limited experiences (Howley & Howley, 2008; PT3, 2002) with computer use in both teacher preparation programs and K-12 professional development. In most teacher preparation programs, students complete a stand-alone educational technology course as part of their requirements for earning their teaching credentials (Brown & Warschauer, 2006; Lambert & Gong, 2010). Beyond this one course, students are typically neither seeing educational technologies modeled in their other core courses, nor are they receiving the hands-on interaction necessary to build confidence in using these technologies with their future students (Brown & Warschauer, 2006; Lambert & Gong, 2010).

To address this problem, a program was designed and implemented for alternative certificate-seeking in-service teachers enrolled in a graduate program. The thrust of the program was to increase the prevalence of technology integration into their classrooms. The program provided the instructors of these graduate students with a professional development experience that would focus on implementing various educational technologies into their content and methods courses within the graduate program experiences. The goal of this professional development program was to provide the instructors' students additional exposure to various educational technologies through instructor modeling and student hands-on engagement. The desired outcome at the end of the program was that the students' confidence, efficacy, and attitude towards technology would be augmented, leading to an increased amount of effective technology integration in their classrooms.

Study Overview

A professional development program was developed to increase the occurrences of technology integration into graduate courses taught by clinical instructors. Entitled *Integrating Content and Technology* (iCAT), the professional development program provided opportunities for these instructors to learn how to integrate a variety of educational technologies into several graduate courses. This study examined graduate level students' perceptions of using educational technology during these courses and in their own classrooms.

This mixed methods study included a total of four student cohorts—two serving as the intervention group receiving the iCAT intervention and two serving as the control group who did not receive the iCAT intervention. Four instructors taught the four cohorts with each cohort completing two, three-credit hour courses. To control for the effect of instructor and to eliminate instructor as an extraneous variable, the instructor was held constant, meaning that the each instructor taught two sections of the same course: one section that received the iCAT intervention and the other section that was considered the control group.

In the study, a questionnaire, designed by the researcher, was used to measure in-service teachers' confidence, self-efficacy, attitudes, and utilization of educational technology in their classrooms, as well as their perceptions about the amount of exposure to various educational technologies they received during their graduate teacher preparation program. Additionally, focus group interviews were conducted to explore the in-service teachers' perceptions about educational technology use in their K-12 classroom and during their graduate courses. Additional artifacts such as instructor reflection logs and informal observation notes were also collected. Both quantitative and qualitative data were utilized to better understand this research problem by examining both of the data sources and then determining whether there was converging evidence from the quantitative and qualitative data (Creswell, 2007), allowing for a complementary analysis.

In this chapter, I discuss the results of this study that were presented in Chapter 4. The discussion focuses on examining and explaining the results obtained from the following research questions:

- Research Question 1—How and to what extent were there differences in confidence, self-efficacy, attitude, and utilization of educational technology for in-service teachers who:
    a. completed two, three-credit hour graduate courses where educational technologies were integrated throughout the course

versus those who completed two, three-hour graduate course where educational technologies were not integrated throughout the course;

b. completed two, three-credit hour graduate courses and had already completed a stand-alone educational technology course (EED531–Teaching with Educational Technology) during their graduate program?

- Research Question 2—How and to what extent were confidence, self-efficacy, attitude, and utilization of educational technology predicted from modeling and hands-on exposure that in-service teachers experienced during a graduate course(s)?

Findings

In this section, I provide a summary of the key points from the complementary data sources described in Chapter 4. I will then discuss these results and how they relate to the previous literature. It is important to note that the qualitative results showed that the study was implemented as outlined in Chapter 3, which helped to provide validity to the findings summarized below.

Research Question 1. In the first research question, I attempted to determine whether there were differences between groups of students who received iCAT training based on their instructors' participation in the professional development program as compared to their counterparts who did not. The participants' data were analyzed from two different perspectives: (a) students who completed two, three-credit hour courses over the course of a 15-week semester, and (b) students who completed two, three-credit hour courses and a stand-alone educational technology course, EED 531–Teaching with Educational Technology, the semester prior to the study.

First, the iCAT and control group participants' data for those who completed two, three-credit hour courses over the 15-week semester were analyzed and the post-intervention findings showed that there were no statistical differences between the two groups for confidence in using technology in everyday life, the integration of educational technologies into their own classrooms, self-efficacy for using technologies, and attitude toward using educational technologies in the classroom. When analyzed with respect to time, there were moderate to large statistical differences between the pre- and post-intervention scores for the confidence, efficacy, and attitude variables for both the treatment and control groups as the program progressed, meaning that the scores for all three of these areas increased from the beginning to the end of the program, regardless of receiving the intervention or not. Similarly, there were also moderate statistical differences for the rate at which the pre- to post-intervention scores for confidence and efficacy increased between the two groups. The data indicated that confidence in everyday use of technology and efficacy for using technology increased more rapidly for those participants who received the iCAT instruction when compared to their counterparts in the control group.

With respect to the previous technology course influencing participants' scores, there were statistically significant outcomes with moderate to large effect sizes for confidence in using technology in everyday life, the perception of integrating technology in the classroom, and efficacy for using technology in the classroom when scores for the participants who completed EED 531 previously were compared to those who had not taken the course. I can conclude that the presence of a stand-alone educational technology course, combined with technology integration throughout additional content and methods courses, can lead to an increase in confidence and efficacy for using educational technology in the classroom as well as increased perceptions of technology integration. Finally, with regard to both the group and previous technology course influencing participants' scores, there was a statistically significant three-way interaction of Time x Group x EED 531 indicating that scores for the participants in the iCAT treatment group who also had completed a previous technology course increased at a greater rate from pre- to post-intervention than their counterparts from the other three groups.

Conclusion

Previous studies have shown that teacher preparation programs are falling short in training teachers to use educational technology in the classroom (Brown, 2006; Rowley et al., 2005; Smerden et al., 2000; Waddoups et al., 2004). More recently, research is beginning to show that by integrating technology throughout teacher preparation programs teachers are becoming more prepared to enter the classroom with the skills required to successfully integrate technology with their students (Brown & Warschauer, 2006). Others contend that many teachers do not feel adequately prepared to use technology in their classrooms (NEA, 2008). Results from this study can help provide direction to decision-makers tasked with the responsibility to continually improve teacher education programs, specifically when addressing the most appropriate way to prepare teachers to teach and learn with technology. The results can help provide direction and understanding in determining whether or not to continue with a stand-alone technology course or infuse those skills throughout the methods courses within the program.

The results from this study also showed that teacher's efficacy for using educational technology can be enhanced by mere exposure during a graduate course. This is a similar finding to other studies that show the teachers' knowledge of educational technology along with the ability to integrate it into their classroom lessons can have a direct impact on their self-efficacy (Levin & Wadmany, 2006; Pierson & McLachlan, 2004; Want, Ertmer, & Newby, 2004).

Through the combination of knowledgeable instructors and appropriate training that includes hands-on experience, teachers are more likely to be better prepared to face the challenges commonly associated with integrating technology into their classrooms (Wang et al., 2004; Moore-Hayes, 2011). This further necessitates the requirement that teacher preparation programs "adequately prepare" their teachers to teach with technology (Schrum, Shelly, and Miller, 2008). The current study is a starting point that can help address this issue by having instructors who are comfortable using technology in their graduate courses, model the use of technology during their lessons, and provide consistent hands-on interaction with the technologies. Only when this approach is mainstream in the teacher preparation programs will we start to see teachers who join the profession feeling comfortable integrating technology in their classrooms on a daily basis.

Research Question 2. In the second research question, I attempted to determine to what extent confidence, self-efficacy, attitude, and utilization of educational technology could be predicted from modeling and hands-on exposure that in-service teachers experienced during their graduate courses. The regression results showed that the amount of hands-on engagement the participants had during their courses was a useful predictor of their confidence in using technology in everyday life, their perceptions about integrating technology in the classroom, and efficacy for using technology in the classroom. Since modeling and hands-on exposure scores were highly correlated, $r = .85$, only hands-on interaction with the technologies was used in conjunction with treatment group to predict confidence, integration, efficacy, and attitude.

From these results, I can conclude that higher levels of hands-on exposure were predictive of higher scores on the criterion variables for these three areas. Most notably, with respect to the perceived amount of technology integration in the in-service teachers' classroom, 37% of the variation could be explained by the amount of class-related hands-on experience in which they participated during their graduate courses. This is a large amount of variation that is accounted for by their perceptions of hands-on engagement.

These results are consistent with other previous studies in which researchers found teachers' self-efficacy would increase as the exposure to and opportunities to participate with technologies increased (Moore-Hayes, 2011;

Wang et al., 2004). Moore-Hayes found that students felt they would be more prepared to use technology in their classrooms if they had hands-on experience using technology during the teacher preparation program. Lastly, simulated learning experiences often enhance student teachers' self-efficacy for using computers in teaching (Wang et al., 2004).

Summary of findings. The main point that can be surmised from the data collected in this study is that confidence, efficacy, and attitude increase over time while the participants were enrolled in graduate courses where the instructors made a conscious effort to integrate technology throughout the curriculum. Additionally, as more technology is embedded in the course, there is a greater increase in confidence and efficacy for using technology. This is consistent with Moore-Hayes (2011) assertion that by providing practical skills for technology integration, specifically in teacher preparation programs, the fear and uncertainty associated with teaching with technology can be diminished.

As the results indicated, the length of exposure to technology in graduate coursework also had a positive influence on confidence and efficacy for using education technology. Specifically, those individuals who participated in the iCAT intervention and who had previously completed a stand-alone educational technology course had greater gains than their counterparts in the other groups. Although further exploration is warranted, the initial inference based on the data from this study is that frequency of hands-on interactions by students plays an important role in participants' confidence, efficacy, and perceived integration of educational technology. These findings are similar to those from a number of studies that emphasized that successful professional development takes place over an extended period of time (Fullan, 1991; Hall & Hord, 2001; Zambo, Buss, & Wetzel, 1999).

Another point to note is that the attitude toward educational technology did not increase significantly throughout the program, regardless of group. One reason for this outcome is that the participants had very high attitude scores at the start of the program. Therefore, scores could not be increased significantly between the pre- and post-intervention questionnaires.

Another conclusion that can be drawn from the qualitative results is that the participants viewed their instructors as mentors in regards to the integration of technology (Adamy & Boulmetis, 2006). The instructors modeled appropriate, pedagogically sound uses of technology in their methods courses throughout the semester. As one student noted during the focus group interview, “I feel more confident. It was really helpful to have [the instructor] model everything.” Thus, modeling by the instructors can have a powerful influence on the students’ use of educational technology in their own classrooms. Moreover, this conclusion is consistent with the existing literature, which indicates that integrating technology throughout the teacher preparation program is a constant theme that recurs throughout the literature (Adamy & Boulmetis, 2006; Brent et al., 2003; Moore-Hayes, 2011; Pope et al., 2002).

With respect to the perceived amount of integration, the results showed that there were no differences in the extent to which the participants from both groups integrated educational technology with their students. Nevertheless, the results also showed that the increased exposure to educational technologies especially through hands-on participation was predictive of the amount that the in-service teachers integrated technology into their own classrooms.

The results about teachers' desiring to integrate technology into their teaching are powerful. Nevertheless, teachers' abilities to integrate technology with their K-12 students are inhibited by potent barriers. This was clearly evident in in frequent dialogue during the focus group interviews that centered on the various barriers participants faced while trying to integrate technology into their classrooms. These barriers included inadequate access to resources and technical support, poor equipment, grade level issues, and lack of proper professional development, especially classroom organization skills for student use of technology, to name a few.

Limitations of the Study

Upon reflecting on the study, it is important to acknowledge the limitations of the study's design and assessments. First, this study was implemented simultaneously with on-going courses in a Masters degree program, meaning that the participants were enrolled in additional classes outside of the iCAT intervention courses. Although the instructors agreed to implement the four iCAT technologies with the treatment sections, but not the control sections, other technologies were presented in the control group courses as well as the iCAT courses. These included Google Docs, Microsoft Office™ products, and other various non-iCAT technologies. The inclusion of these technologies very well could have influenced the results and been a variable that affected why there were no between-group effects for efficacy, attitude, and integration of educational technology by the participants, which was presented in Chapter 4.

A second limitation was the relatively homogeneous participant population that played a part in this study. The participants were enrolled in a specialized graduate program, Induction with Masters and Certification, and they were all in-service teachers who taught in lower socio-economic settings. Including in-service teachers who teach in a variety of settings and who are enrolled in various graduate programs could give a broader view of the effectiveness of a professional development experience similar to the iCAT program.

This limitation can also be substantiated by the lack of significant results in a few key areas. First, although there were significant differences for the rate at which confidence and efficacy scores increased between the two groups, i.e., the Time x Group interactions, there was no significant difference for the perceived integration of educational technology in the classroom. Further, both groups were teaching in schools where inadequate access to resources was a common trend that may have influenced these results. Similarly, with the exception of the changes for the within-group analysis for time, the increase from pre- to post-intervention questionnaire, which would be anticipated, there were no significant differences for the attitude scores between the two groups. The most likely explanation for this result was that, as a whole, the participants had a positive attitude toward educational technology. There was a "ceiling effect" with no real room for growth from pre- to post-intervention scores in this area.

Recommendations

Decision-makers continue to debate the need for either a stand-alone educational technology course or technology-infused methods courses throughout teacher preparation programs. For its undergraduate programs, the university where this current study was conducted has recently transitioned from a stand-alone educational technology class to a set of technology-infused methods courses for preservice students. In an ongoing study, Foulger, Buss, Wetzel, & Lindsey (in press), found that confidence for using technology and technological pedagogical content knowledge (TPACK) increased for undergraduate students who participated in a stand-alone course. In this section, I will present my recommendations for improving (a) the iCAT program and (b) the teacher preparation programs at this university and other programs that face similar situations.

iCAT program. Major modifications for improving the iCAT program became apparent when reflecting on the study. First, because of the lack of equipment and strict Internet policies in the local school districts, it is important that the technologies used in the iCAT program be accessible to the participants so that there can be an easier transfer of knowledge from the university classroom to daily K-12 teaching. The university can help to bridge the accessibility concerns using a few approaches. One way is to provide the local schools with equipment that beginning teachers could take into their classrooms. This would also require communication between the university and district decision makers regarding technology policies (access to wireless Internet, unblocking educational sites, etc.) so that beginning teachers could implement the technologies more readily in their own classrooms.

Another solution is to work with the local school districts to develop a Bring Your Own Device (BYOD) program so that each student has access to the proper equipment. BYOD programs are programs where each student brings his or her personal handheld device to school. Districts can provide handheld devices to individuals who do not have their own. This is more appropriate at the middle and high school levels, but by initiating a BYOD program, school districts can help ensure that students are connected to just-in-time learning. A BYOD program may appear to be costly to develop initially. However, mobile devices are prevalent in today's society and K-12 students would benefit greatly from gaining the knowledge of how to use the devices for learning situations. In my past experience, school districts spent a tremendous amount of money on interactive whiteboards. However, if one were to walk into a classroom today, chances are that many would either be used as a traditional presentation tool or not be used at all.

Finally, teacher participants mentioned during the interviews that they were afraid to let their students use the technology that was available to them because they felt they did not have procedures in place to manage the use of the technology. An important topic to include while teacher participants are learning how to use various educational technologies is different classroom management techniques that teachers can reference to help them integrate technology more seamlessly. Specifically, beginning teachers should have the opportunity to critique classroom videos in which K-12 classroom teachers are modeling appropriate technology integration and classroom management techniques to help new teachers better understand how to manage technology in their classrooms. Similarly, best practices for classroom management for technology should be discussed during graduate courses and then included in lesson plans that beginning teachers develop for their classrooms.

Teacher preparation programs. At the teacher preparation program level, two competing approaches have been employed: a stand-alone educational technology course typically taught by instructors with a strong technological pedagogical knowledge (TPK) foundation or technology-infused methods courses taught by instructors who have a stronger content and pedagogical knowledge (CPK) foundation. My recommendation, based on this study, is to infuse technology throughout the teacher preparation program beginning with a stand-alone technology course and following up with technology-infused methods courses. Technology plays an integral part of many individuals' personal and professional lives. Teachers need to have the tools to prepare their students to use a variety of technologies so that the students can compete in today's workforce. For teachers to effectively learn how to use these tools in their K-12 classrooms and have the efficacy and confidence to integrate technologies into their own teaching, they need to see a variety of technologies modeled by their instructors and have the opportunity to interact with those technologies using hands-on activities during their teacher preparation program. This assertion was echoed by a former NEA's President, Reginald Weaver who stated, "How can we expect our teachers to provide kids with the education they need to join today's high-tech work without the necessary equipment and training?" (Downey, Pierce, Devaney, Stansbury & Carter, 2008, p. 6).

The ultimate goal is to have technology seamlessly embedded throughout courses so that it is no longer seen as a "separate" content area. To reach this goal, my recommendation for a teacher preparation program would be to (a) continue with a stand-alone technology course and then (b) employ experts who have a strong TCK foundation to work with methods course instructors to infuse technology into their current courses so that students can see a variety of technologies modeled and have the chance to interact with the technologies on a consistent basis. The results from this study clearly validate this perspective. Instructors who became comfortable infusing technology into their courses had students that showed increases in confidence and efficacy for using technology in the classroom. Additionally, the more the participants had the opportunity to interact with those technologies, the faster their efficacy and confidence increased.

Further Research

The findings of this study indicate teachers' efficacy and attitude toward using educational technology increased along with their perceptions about integrating technology with their students. The study provided initial evidence that demonstrated how different educational technologies that were modeled and used in hands-on experiences throughout graduate courses positively influenced teachers' efficacy and attitude toward using those various technologies.

Based on the findings and limitations of the study, I recommend that future research studies should include a larger scale effort to integrate educational technologies throughout a graduate program allowing for the opportunity to further explore this area. The findings of this study can be confirmed, disconfirmed, or elaborated on by conducting similar studies. By providing a professional development model, such as the iCAT program used during this study to all instructors within a graduate program, a clearer picture of the effectiveness of such a program may be obtained. The essential components of the program would include a variety of strategies so the instructors can gain the expertise to successfully model the use of educational technologies in their graduate courses, as well as incorporating these various technologies through the use of hands-on activities by their students. Thus, to prepare course instructors, strategies might include one-on-one coaching, group learning sessions, just-in-time tips, and communities of practice, where the instructors can discuss and present ideas for successfully using technology in their courses.

In addition to implementing this program and studying the results across an entire graduate program, further investigation should include studying both preservice and in-service teachers who are enrolled in various undergraduate and graduate education programs. Likewise, further investigation of preservice and in-service teachers working with students in a variety of socio-economic settings is an important next step because barriers with regard to technology may be more closely examined.

Another direction for a future study would be to explore how teachers are integrating technology into their K-12 classrooms after seeing it implemented throughout their graduate courses. The larger scale study should compare classrooms where technology resources are both scant (i.e. one computer classroom) and abundant (mobile technologies, school-wide Wifi access, interactive whiteboards, etc.) to determine how teachers are using technology with various socio-economic student populations. For example, are teachers using technologies for basic skill-focused activities or are they using technology to provide rich learning experiences that promote higher-level thinking?

Finally, although this study did not specifically address the high demands and anxiety level of these first- and second-year teachers who are also completing a graduate degree, the results of this study suggest excessive demands and anxiety might be reasons for a lack of transfer between the graduate classroom and everyday teaching in the K-12 setting. This is an area that could be considered in future studies and, which would provide additional evidence to either confirm or disconfirm Liu & Szabo's (2009) findings that teachers struggle to find time to integrate technology in their curriculum because of a number of other personal and professional demands, and lack of time and energy. Based on the interview responses, participants in the iCAT group appeared more willing to try to integrate technologies with their students, however, there seems to be a disconnect between willingness to integrate technology in the classroom and actually integrating the technology, which may result from other demands on time and energy.

Conclusion

Results from previous studies have shown that teacher preparation programs are falling short with respect to training teachers to use educational technology in the classroom (Brown, 2006; Rowley et al., 2005; Smerden et al., 2000; Waddoups et al., 2004). More recently, research results have begun to show that by integrating technology throughout teacher preparation programs teachers are becoming better prepared to enter the classroom with the skills required to successfully integrate technology with their students (Brown & Warschauer, 2006). By comparison, others contend that many teachers do not feel adequately prepared to use technology in their classrooms (NEA, 2008). Results from this study can help provide direction to decision-makers tasked with the responsibility to continually improve teacher education programs, specifically when addressing the most appropriate way to prepare teachers to learn an subsequently teach with technology. The results have helped to provide direction and understanding in determining to the continued need to employ a stand-alone technology course or/and infuse those skills throughout the methods courses within the program.

The results from this study also showed that teacher's efficacy for using educational technology can be enhanced by exposure during a graduate course. This is a similar finding to other studies that show the teachers' knowledge of educational technology along with the ability to integrate it into their classroom lessons can have a direct effect on their self-efficacy (Levin & Wadmany, 2006; Pierson & McLachlan, 2004; Want, Ertmer, & Newby, 2004).

Through the combination of knowledgeable instructors and appropriate training that includes hands-on experience, teachers are more likely to be better prepared to face the challenges commonly associated with integrating technology into their classrooms (Wang et al., 2004; Moore-Hayes, 2011). This further suggests that teacher preparation programs must "adequately prepare" their teachers to teach with technology (Schrum, Shelly, & Miller, 2008). The current study is a starting point that can help address this issue by having instructors who are comfortable using technology in their graduate courses, model the use of technology during their lessons, and provide consistent hands-on interaction for their charges with the selected technologies. Only when this approach becomes mainstream within teacher preparation programs will we begin to see teachers who enter the profession feeling comfortable with integrating technology into their classroom instruction on a daily basis.

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APPENDIX A

RECRUITMENT EMAIL TO INSTRUCTORS

Comparing graduate courses taught by the same instructor using competing approaches: Traditional vs. Technology-infused

Dear Instructor:

I am a graduate student under the direction of Professor Keith Wetzel in the Mary Lou Fulton Teachers College at Arizona State University. I am conducting a research study to determine teacher efficacy, attitude toward, and utilization of educational technologies in the classroom.

I am recruiting several instructors to participate in the study by working with me collaboratively in a professional development program. In order to participate in the professional development program you must meet the following criteria that has been approved by the Associate Division Direct:

1. Teach at least two sections of the same class during the Spring 2012 semester.
2. Volunteer to modify one section course in order integrate technology (intervention). The other section would remain consistent with the way it was previously taught (control).
3. Agree to meet with researcher and other participating instructors approximately ten times for roughly 30-60 minutes throughout the course of the Spring 2012 semester.
4. Document the use of technology in their classes by both the instructor and students and any differences they noticed between the two sections.

Your participation in this study is voluntary. If you have any questions concerning the research study, please call me at (602) 885- 1608 or email at tkisicki@asu.edu.

Sincerely,

Todd Kisicki

APPENDIX B

INSTRUCTOR PARTICIPATION CONSENT LETTER

Comparing graduate courses taught by the same instructor using competing approaches: Traditional vs Technology-infused

Dear ______________________:

I am a doctoral student under the direction of Dr. Keith Wetzel at Arizona State University. I am conducting research as part of the requirements to complete my doctoral dissertation in Educational Technology. The focus of the study is to determine teacher self-efficacy, utilization, and attitude toward educational technology in the classroom. I am inviting you to participate in the study by working with me collaboratively in a professional development program.

I am inviting your participation, which will involve integrating various technologies into one of your courses during the 15-week Spring 2012 semester. Additionally, we will meet approximately ten times for roughly 30-60 minutes during the semester. Our meetings will consist of face-to-face meetings and online communications. During this process, I will ask you to provide me with a copy of your course syllabus and to keep track of our progress using an electronic document. Additionally, I will observe a class session where I take informal field notes of how technology is being used in your class (no recording devices will be used). If you agree to these items your responses may help make a contribution to the information known about teacher self-efficacy, utilization, and attitudes toward educational technology in the classroom.

Your participation in this study is voluntary. If you choose not to participate or to withdraw from the study at any time, there will be no penalty. There are no foreseeable risks or discomforts to your participation and you must be 18 years or older to participate in this study. You have the right not to answer any question, and to stop participation at any time. Your individual responses to the electronic document and syllabus will be kept confidential within password-protected files kept by the research investigators. The results of this study may be used in reports, presentations, or publications but your name will never be used.

If you have any questions concerning the research study, please contact Todd Kisicki at tkisicki@asu.edu (co-investigator) or Dr. Keith Wetzel at k.wetzel@asu.edu (principal investigator). If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788.

By signing below you are agreeing to participate to in the study.

____

Signature Date

APPENDIX C

INTERVENTION QUESTIONNAIRE CONSENT LETTER

Comparing graduate courses taught by the same instructor using competing approaches: Traditional vs. Technology-infused

Dear Participant:

I am a doctoral student under the direction of Dr. Keith Wetzel at Arizona State University.
I am conducting research as part of the requirements to complete my doctoral dissertation in Educational Technology. The focus of the study is to determine teacher self-efficacy, utilization, and attitude toward educational technology in the classroom. I am inviting you to participate in filling-out the following questionnaire that will help me gather important data on the topic.

The questionnaire will take approximately 10-15 minutes and your participation is voluntary. If you choose to fill-out the questionnaire your responses may help make a contribution to the information known about teacher self-efficacy, utilization, and attitudes toward educational technology in the classroom. There are no foreseeable risks or discomforts to your participation. Participants must be 18 or older.

Your individual responses to the questionnaire are anonymous and will only be seen by the research investigators. All data will be kept confidential within a password-protected database kept by the research investigators. The aggregate results of this study may be used in reports, presentations, or publications but your name will never be used.

If you have any questions concerning the research study, please contact Todd Kisicki at tkisicki@asu.edu (co-investigator) or Dr. Keith Wetzel at k.wetzel@asu.edu (principal investigator). If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788.

Return of the questionnaire is your consent to participate.

Sincerely,

Todd Kisicki

APPENDIX D

FOCUS GROUP INTERVIEW CONSENT LETTER

Comparing graduate courses taught by the same instructor using competing approaches: Traditional vs. Technology-infused

Dear ______________________:

I am a doctoral student under the direction of Dr. Keith Wetzel at Arizona State University. I am conducting a research study to determine teacher efficacy, attitude toward, and utilization of educational technologies in the classroom.

I am inviting your participation in a focus group interview, which will involve answering questions about how you use educational technology in your classroom and during your graduate program. The focus group interview will take approximately 20-30 minutes. You have the right not to answer any question, and to stop participation at any time.

Your participation in this study is voluntary. If you choose not to participate or to withdraw from the study at any time, there will be no penalty, for example, it will not affect your grade.

Your individual responses to the interview are confidential and will only be seen by the research investigators. The interviews will be recorded and transcribed. All responses and transcriptions will be kept confidential within password-protected files kept by the research investigators. The results of this study may be used in reports, presentations, or publications but your name will never be used. There are no foreseeable risks or discomforts to your participation. You must be 18 years or older to participate in this study.

I would like to video record this focus group so that I can transcribe the interviews to ensure that I have accurate statements for each interviewee. You will not be recorded, unless you give permission. If you give permission for to be recorded, you have the right to ask for the recording to be stopped. The video files will be kept within password-protected folders and will be destroyed at the conclusion of the research project. Complete confidentiality cannot be guaranteed due to the group nature.

If you have any questions concerning the research study, please contact Todd Kisicki at tkisicki@asu.edu (coinvestigator) or Dr. Keith Wetzel at k.wetzel@asu.edu (principal investigator). If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788.

By signing below you are agreeing to participate to in the study.

____

Signature Date

By signing below, you are agreeing to be video recorded.

____

Signature Date

APPENDIX E

FOCUS GROUP RECRUITMENT SCRIPT

Comparing graduate courses taught by the same instructor using competing approaches: Traditional vs. Technology-infused

Script

I am a graduate student under the direction of Professor Keith Wetzel in the Mary Lou Fulton Teachers College at Arizona State University. I am conducting a research study to determine teacher efficacy, attitude toward, and utilization of educational technologies in the classroom.

I am recruiting individuals to participate in a focus group interview to determine how you use educational technology in your classroom and during your graduate program. The focus group will take approximately 20-30 minutes. You must be 18 or older to participate.

Your participation in this study is voluntary. If you have any questions concerning the research study, please call me at (602) 885- 1608 or email at tkisicki@asu.edu.

APPENDIX F

PRE-INTERVENTION QUESTIONNAIRE

(iCAT) Technology in Education (pre)

1. Introduction

Dear Participant:

I am a doctoral student under the direction of Dr. Keith Wetzel at Arizona State University.

I am conducting research as part of the requirements to complete my doctoral dissertation in Educational Technology. The focus of the study is to determine teacher self-efficacy, utilization, and attitude toward educational technology in the classroom. I am inviting you to participate in completing the following questionnaire that will help me gather important data on the topic.

The questionnaire will take approximately 10-15 minutes to complete and your participation is voluntary. If you choose to complete the questionnaire your responses will help make a contribution to the information known about teacher self-efficacy, utilization, and attitudes toward educational technology in the classroom. There are no foreseeable risks or discomforts to your participation. Participants must be 18 or older to complete this questionnaire.

Your individual responses to the questionnaire are anonymous and will only be seen by the research investigators. All data will be kept confidential within a password-protected database kept by the research investigators. The aggregate results of this study may be used in reports, presentations, or publications but your name will never be used.

If you have any questions concerning the research study, please contact Todd Kisicki at tkisicki@asu.edu (co-investigator) or Dr. Keith Wetzel at k.wetzel@asu.edu (principal investigator). If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788.

Return of the questionnaire is your consent to participate.

Sincerely,

Todd Kisicki

Page 1

(iCAT) Technology in Education (post)

2. Using Technology

Select the appropriate responses for each educational technology listed below.

***1. Indicate the level of confidence you have USING the following educational technologies.**
1=Not at all confident
2=A little confident
3=Somewhat confident
4=Quite confident
5=Highly confident
6=Extremely confident

	1: Not at all	2	3	4	5	6: Extremely
Microsoft Office Suites (Word, Excel, PowerPoint)	◯	◯	◯	◯	◯	◯
Internet as a learning tool	◯	◯	◯	◯	◯	◯
Google Docs (document, spreadsheets, presentations, forms)	◯	◯	◯	◯	◯	◯
Classroom Responses Systems (Poll Everywhere, clickers)	◯	◯	◯	◯	◯	◯
Google Earth	◯	◯	◯	◯	◯	◯
Handheld devices (iPads, iPod touch, etc)	◯	◯	◯	◯	◯	◯
Interactive Whiteboards (SMART, Promethean, etc)	◯	◯	◯	◯	◯	◯
Video Conferencing (Skype, iChat, Facetime, etc)	◯	◯	◯	◯	◯	◯
Creating Videos (MovieMaker, iMovie, Camtasia, Jing, etc)	◯	◯	◯	◯	◯	◯
Google Sites (create your own web site)	◯	◯	◯	◯	◯	◯
Wikis (Wikispaces, Wikipedia, etc)	◯	◯	◯	◯	◯	◯
Blogs (Blogger, etc)	◯	◯	◯	◯	◯	◯
Podcasts (iTunes, Podcastalley, etc)	◯	◯	◯	◯	◯	◯
Digital Posterboards (Glogs, Share, ect)	◯	◯	◯	◯	◯	◯
Social Networking Sites	◯	◯	◯	◯	◯	◯

3. Integrating Technology

Select the appropriate responses for each educational technology listed below.

***1. How frequently do you INTEGRATE the following technologies into your classroom teaching?**
1=Do not use at all
2=Use it a little
3=Use it somewhat
4=Use it quite a bit
5=Use it a lot
6=Use it extensively

	1: Do not use	2	3	4	5	6: Use extensively
Microsoft Office Suites (Word, Excel, PowerPoint)	◯	◯	◯	◯	◯	◯
Internet as a learning tool	◯	◯	◯	◯	◯	◯
Google Docs (document, spreadsheets, presentations, forms)	◯	◯	◯	◯	◯	◯
Classroom Responses Systems (Poll Everywhere, clickers)	◯	◯	◯	◯	◯	◯
Google Earth	◯	◯	◯	◯	◯	◯
Handheld devices (iPads, iPod touch, PDA, etc)	◯	◯	◯	◯	◯	◯
Interactive Whiteboards (SMART, Promethean, etc)	◯	◯	◯	◯	◯	◯
Video Conferencing (Skype, iChat, Oovoo, etc)	◯	◯	◯	◯	◯	◯
Creating Videos (MovieMaker, iMovie, Camtasia, Jing, etc)	◯	◯	◯	◯	◯	◯
Google Sites (create your own web site)	◯	◯	◯	◯	◯	◯
Wikis (Wikispaces, Wikipedia, etc)	◯	◯	◯	◯	◯	◯
Blogs (Blogger, etc)	◯	◯	◯	◯	◯	◯
Podcasts (iTunes, Podcastalley, etc)	◯	◯	◯	◯	◯	◯
Digital Posterboards (Glogs, Share, ect)	◯	◯	◯	◯	◯	◯
Social Networking Sites	◯	◯	◯	◯	◯	◯

(iCAT) Technology in Education (post)

4. Using and Integrating Technology

Please respond to each statement listed below.

***1. Please respond to each statement listed below.**

1=Strongly Disagree
2=Moderately Disagree
3=Slightly Disagree
4=Slightly Agree
5=Moderately Agree
6=Strongly Agree

	1: Strongly Disagree	2	3	4	5	6: Strongly Agree
I feel prepared to integrate educational technology with my students.	○	○	○	○	○	○
The professional development that I have received from my school has helped prepare me to integrate educational technology with my students.	○	○	○	○	○	○
This class has helped prepare me to integrate educational technology with my students.	○	○	○	○	○	○
I can teach an assignment where my students use Microsoft Office during the assignment.	○	○	○	○	○	○
I can teach an assignment where my students use the Internet during the assignment.	○	○	○	○	○	○
I can teach an assignment where my students use Classroom Response Systems (clickers or cell phones) during the assignment.	○	○	○	○	○	○
I can teach an assignment where my students use Google Earth during the assignment.	○	○	○	○	○	○
I can teach an assignment	○	○	○	○	○	○

(iCAT) Technology in Education (pre)

where my students use handheld devices during the assignment.	○	○	○	○	○	○
I can teach an assignment where my students use Interactive Whiteboards during the assignment.	○	○	○	○	○	○
I can teach an assignment where my students use Video Conferencing during the assignment.	○	○	○	○	○	○
I can teach an assignment where my students use create videos during the assignment.	○	○	○	○	○	○
I can teach an assignment where my students use Web 2.0 tools (Wikis, Podcasts, Blogs, Glogs) during the assignment.	○	○	○	○	○	○
I can teach an assignment where my students use Social Networking Sites (ePals, Edmodo, Facebook, Twitter, etc) during the assignment.	○	○	○	○	○	○
I can integrate educational technology into my content instruction area.	○	○	○	○	○	○
I can motivate my students using educational technology.	○	○	○	○	○	○
I understand the need to use educational technology in my classroom.	○	○	○	○	○	○
I can use educational technology to help my students think critically.	○	○	○	○	○	○
I observe fewer behavior problems when I integrate educational technology into my teaching.	○	○	○	○	○	○
I can assess my students who use educational technology.	○	○	○	○	○	○
I can teach my students to use educational technology.	○	○	○	○	○	○
I can get students to believe they can do well in school by using educational	○	○	○	○	○	○

Page 5

technology.						
I feel good about using technology.	◯	◯	◯	◯	◯	◯
Technology is a great aid to education.	◯	◯	◯	◯	◯	◯
I have a better attitude about using technology than other teachers.	◯	◯	◯	◯	◯	◯
I am a 21st century learner.	◯	◯	◯	◯	◯	◯
In general, I am happy with how I use technology.	◯	◯	◯	◯	◯	◯
Technology makes teaching easier.	◯	◯	◯	◯	◯	◯
My students are more engaged when I use technology.	◯	◯	◯	◯	◯	◯

(iCAT) Technology in Education (pre)

5. Demographics

***1. Participant ID (ASU ID)**

These questionnaires are confidential. We would like to be able to compare pre and post data from the questionnaire data.

***2. In Which program are you enrolled?**

- Elementary Education
- Secondary Education
- Special Education

***3. Have you taken EED 531 - Teaching with Educational Technology - during your InMAC program?**

- Yes
- No

***4. For which class and instructor are you completing this questionnaire?**

- Bostick - SED 533
- Brass - EED537
- Hoffner - EED 529
- Preach - RDG532
- Roggeman - RDG 507
- Tovar - EED 511

***5. What day of the week did your class meet?**

- Monday
- Tuesday

(iCAT) Technology in Education (pre)

***6. In which semester are your currently enrolled?**

- ◯ 1st year/1st semester
- ◯ 1st year/2nd semester
- ◯ 2nd year/1st semester
- ◯ 2nd year/2nd semester

***7. At which grade level are you currently teaching?**

***8. List the educational technologies to which you have access in your current teaching placement.**

APPENDIX G

POST-INTERVENTION QUESTIONNAIRE

(iCAT) Technology in Education (post)

1. Introduction

Dear Participant:

I am a doctoral student under the direction of Dr. Keith Wetzel at Arizona State University.

I am conducting research as part of the requirements to complete my doctoral dissertation in Educational Technology. The focus of the study is to determine teacher self-efficacy, utilization, and attitude toward educational technology in the classroom. I am inviting you to participate in completing the following questionnaire that will help me gather important data on the topic.

The questionnaire will take approximately 10-15 minutes to complete and your participation is voluntary. If you choose to complete the questionnaire your responses will help make a contribution to the information known about teacher self-efficacy, utilization, and attitudes toward educational technology in the classroom. There are no foreseeable risks or discomforts to your participation. Participants must be 18 or older to complete this questionnaire.

Your individual responses to the questionnaire are anonymous and will only be seen by the research investigators. All data will be kept confidential within a password-protected database kept by the research investigators. The aggregate results of this study may be used in reports, presentations, or publications but your name will never be used.

If you have any questions concerning the research study, please contact Todd Kisicki at tkisicki@asu.edu (co-investigator) or Dr. Keith Wetzel at k.wetzel@asu.edu (principal investigator). If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788.

Return of the questionnaire is your consent to participate.

Sincerely,

Todd Kisicki

Page 1

(iCAT) Technology in Education (post)

2. Using Technology

Select the appropriate responses for each educational technology listed below.

***1. Indicate the level of confidence you have USING the following educational technologies.**
1=Not at all confident
2=A little confident
3=Somewhat confident
4=Quite confident
5=Highly confident
6=Extremely confident

	1: Not at all	2	3	4	5	6: Extremely
Microsoft Office Suites (Word, Excel, PowerPoint)	○	○	○	○	○	○
Internet as a learning tool	○	○	○	○	○	○
Google Docs (document, spreadsheets, presentations, forms)	○	○	○	○	○	○
Classroom Responses Systems (Poll Everywhere, clickers)	○	○	○	○	○	○
Google Earth	○	○	○	○	○	○
Handheld devices (iPads, iPod touch, etc)	○	○	○	○	○	○
Interactive Whiteboards (SMART, Promethean, etc)	○	○	○	○	○	○
Video Conferencing (Skype, iChat, Facetime, etc)	○	○	○	○	○	○
Creating Videos (MovieMaker, iMovie, Camtasia, Jing, etc)	○	○	○	○	○	○
Google Sites (create your own web site)	○	○	○	○	○	○
Wikis (Wikispaces, Wikipedia, etc)	○	○	○	○	○	○
Blogs (Blogger, etc)	○	○	○	○	○	○
Podcasts (iTunes, Podcastalley, etc)	○	○	○	○	○	○
Digital Posterboards (Glogs, Share, ect)	○	○	○	○	○	○
Social Networking Sites	○	○	○	○	○	○

(iCAT) Technology in Education (post)

3. Integrating Technology

Select the appropriate responses for each educational technology listed below.

***1. How frequently do you INTEGRATE the following technologies into your classroom teaching?**
1=Do not use at all
2=Use it a little
3=Use it somewhat
4=Use it quite a bit
5=Use it a lot
6=Use it extensively

	1: Do not use	2	3	4	5	6: Use extensively
Microsoft Office Suites (Word, Excel, PowerPoint)	○	○	○	○	○	○
Internet as a learning tool	○	○	○	○	○	○
Google Docs (document, spreadsheets, presentations, forms)	○	○	○	○	○	○
Classroom Responses Systems (Poll Everywhere, clickers)	○	○	○	○	○	○
Google Earth	○	○	○	○	○	○
Handheld devices (iPads, iPod touch, PDA, etc)	○	○	○	○	○	○
Interactive Whiteboards (SMART, Promethean, etc)	○	○	○	○	○	○
Video Conferencing (Skype, iChat, Oovoo, etc)	○	○	○	○	○	○
Creating Videos (MovieMaker, iMovie, Camtasia, Jing, etc)	○	○	○	○	○	○
Google Sites (create your own web site)	○	○	○	○	○	○
Wikis (Wikispaces, Wikipedia, etc)	○	○	○	○	○	○
Blogs (Blogger, etc)	○	○	○	○	○	○
Podcasts (iTunes, Podcastalley, etc)	○	○	○	○	○	○
Digital Posterboards (Glogs, Share, ect)	○	○	○	○	○	○
Social Networking Sites	○	○	○	○	○	○

(iCAT) Technology in Education (post)

4. Using and Integrating Technology

Please respond to each statement listed below.

***1. Please respond to each statement listed below.**

1=Strongly Disagree
2=Moderately Disagree
3=Slightly Disagree
4=Slightly Agree
5=Moderately Agree
6=Strongly Agree

	1: Strongly Disagree	2	3	4	5	6: Strongly Agree
I feel prepared to integrate educational technology with my students.	○	○	○	○	○	○
The professional development that I have received from my school has helped prepare me to integrate educational technology with my students.	○	○	○	○	○	○
This class has helped prepare me to integrate educational technology with my students.	○	○	○	○	○	○
I can teach an assignment where my students use Microsoft Office during the assignment.	○	○	○	○	○	○
I can teach an assignment where my students use the Internet during the assignment.	○	○	○	○	○	○
I can teach an assignment where my students use Classroom Response Systems (clickers or cell phones) during the assignment.	○	○	○	○	○	○
I can teach an assignment where my students use Google Earth during the assignment.	○	○	○	○	○	○
I can teach an assignment	○	○	○	○	○	○

(iCAT) Technology in Education (post)

where my students use handheld devices during the assignment.						
I can teach an assignment where my students use Interactive Whiteboards during the assignment.	◯	◯	◯	◯	◯	◯
I can teach an assignment where my students use Video Conferencing during the assignment.	◯	◯	◯	◯	◯	◯
I can teach an assignment where my students use create videos during the assignment.	◯	◯	◯	◯	◯	◯
I can teach an assignment where my students use Web 2.0 tools (Wikis, Podcasts, Blogs, Glogs) during the assignment.	◯	◯	◯	◯	◯	◯
I can teach an assignment where my students use Social Networking Sites (ePals, Edmodo, Facebook, Twitter, etc) during the assignment.	◯	◯	◯	◯	◯	◯
I can integrate educational technology into my content instruction area.	◯	◯	◯	◯	◯	◯
I can motivate my students using educational technology.	◯	◯	◯	◯	◯	◯
I understand the need to use educational technology in my classroom.	◯	◯	◯	◯	◯	◯
I can use educational technology to help my students think critically.	◯	◯	◯	◯	◯	◯
I observe fewer behavior problems when I integrate educational technology into my teaching.	◯	◯	◯	◯	◯	◯
I can assess my students who use educational technology.	◯	◯	◯	◯	◯	◯
I can teach my students to use educational technology.	◯	◯	◯	◯	◯	◯
I can get students to believe they can do well in school by using educational	◯	◯	◯	◯	◯	◯

(iCAT) Technology in Education (post)

technology.						
I feel good about using technology.	◯	◯	◯	◯	◯	◯
Technology is a great aid to education.	◯	◯	◯	◯	◯	◯
I have a better attitude about using technology than other teachers.	◯	◯	◯	◯	◯	◯
I am a 21st century learner.	◯	◯	◯	◯	◯	◯
In general, I am happy with how I use technology.	◯	◯	◯	◯	◯	◯
Technology makes teaching easier.	◯	◯	◯	◯	◯	◯
My students are more engaged when I use technology.	◯	◯	◯	◯	◯	◯

5. Observation Experience

Select the appropriate responses for each educational technology listed below.

***1. I have seen this technology modeled by my instructor during this course.**
0=not at all modeled
1=modeled a little
2=modeled moderately
3=modeled a great deal

	0	1	2	3
Microsoft Office Suites (Word, Excel, PowerPoint)	○	○	○	○
Internet as a learning tool	○	○	○	○
Google Docs (document, spreadsheets, presentations, forms)	○	○	○	○
Classroom Responses Systems (Poll Everywhere, clickers)	○	○	○	○
Google Earth	○	○	○	○
Handheld devices (iPads, iPod touch, PDA, etc)	○	○	○	○
Interactive Whiteboards (SMART, Promethean, etc)	○	○	○	○
Video Conferencing (Skype, iChat, Oovoo, etc)	○	○	○	○
Creating Videos (MovieMaker, iMovie, Camtasia, Jing, etc)	○	○	○	○
Google Sites (create your own web site)	○	○	○	○
Wikis (Wikispaces, Wikipedia, etc)	○	○	○	○
Blogs (Blogger, etc)	○	○	○	○
Podcasts (iTunes, Podcastalley, etc)	○	○	○	○
Digital Posterboards (Glogs, Share, ect)	○	○	○	○
Social Networking Sites	○	○	○	○
Overall, how often was technology modeled by your instructor during this course?	○	○	○	○

6. Hands-on Experience

Select the appropriate responses for each educational technology listed below.

***1. I have had hands on experience using this technology during this course.**
0=no hands on experience
1=a little hands on experience
2=a moderate amount of hands on experience
3=a great deal of hands on experience

	0	1	2	3
Microsoft Office Suites (Word, Excel, PowerPoint)	○	○	○	○
Internet as a learning tool	○	○	○	○
Google Docs (document, spreadsheets, presentations, forms)	○	○	○	○
Classroom Responses Systems (Poll Everywhere, clickers)	○	○	○	○
Google Earth	○	○	○	○
Handheld devices (iPads, iPod touch, PDA, etc)	○	○	○	○
Interactive Whiteboards (SMART, Promethean, etc)	○	○	○	○
Video Conferencing (Skype, iChat, Oovoo, etc)	○	○	○	○
Creating Videos (MovieMaker, iMovie, Camtasia, Jing, etc)	○	○	○	○
Google Sites (create your own web site)	○	○	○	○
Wikis (Wikispaces, Wikipedia, etc)	○	○	○	○
Blogs (Blogger, etc)	○	○	○	○
Podcasts (iTunes, Podcastalley, etc)	○	○	○	○
Digital Posterboards (Glogs, Share, ect)	○	○	○	○
Social Networking Sites	○	○	○	○
Overall, how often did you have hands on experience using technology for this course?	○	○	○	○

7. Demographics

***1. Participant ID (ASU ID)**

These questionnaires are confidential. We would like to be able to compare pre and post data from the questionnaire data.

***2. In Which program are you enrolled?**

- ◯ Elementary Education
- ◯ Secondary Education
- ◯ Special Education

***3. Have you taken EED 531 - Teaching with Educational Technology - during your InMAC program?**

- ◯ Yes
- ◯ No

***4. For which class and instructor are you completing this questionnaire?**

- ◯ Bostick - SED 533
- ◯ Brass - EED537
- ◯ Hoffner - EED 529
- ◯ Preach - RDG532
- ◯ Roggeman - RDG 507
- ◯ Tovar - EED 511

***5. What day of the week did your class meet?**

- ◯ Monday
- ◯ Tuesday

***6. In which semester are your currently enrolled?**

- ○ 1st year/1st semester
- ○ 1st year/2nd semester
- ○ 2nd year/1st semester
- ○ 2nd year/2nd semester

***7. At which grade level are you currently teaching?**

***8. List the educational technologies to which you have access in your current teaching placement.**
Check all that apply.

- ☐ Document camera
- ☐ Classroom Response Systems (clickers, Poll Everywhere, etc)
- ☐ Handheld devices (iPads, iPod touches, etc)
- ☐ Internet (and Internet resources)
- ☐ Interactive Whiteboard (Smartboard, Promethean, etc)
- ☐ LCD Projector
- ☐ Overhead projector (the kind that uses transparency sheets)
- ☐ Podcasts
- ☐ Screencasts
- ☐ Student computers
- ☐ Wifi (wireless Internet connection)
- ☐ I do not have access to any of the above technologies.

Other (please specify)

APPENDIX H

FOCUS GROUP INTERVIEW QUESTIONS

Comparing graduate courses taught by the same instructor using competing approaches: Traditional vs. Technology-infused

1. On a scale of 1-5, how comfortable would you say you are using and learning technologies?

2. What technologies did you see modeled in your class this semester? How often? How were they used?

3. What technologies did you have hands-on experience using in your class this semester? How often? How were they used?

4. What educational technologies do you use with your students? How do you integrate those technologies with your students?

5. Have your beliefs that you can integrate technology into your classroom instruction changed over the semester due to this course (or the combination of two courses)?

6. Has your attitude toward integrating various educational technologies changed since the start of this semester due to this course (or the combination of two courses)?

7. Has your integration of various educational technologies changed since the start of this semester due to this course (or the combination of two courses)?

8. Is there anything else you would like to add?

APPENDIX I

FOCUS GROUP INTERVIEW RECRUITMENT PROTOCOL

1. During the administration of the post-intervention questionnaire, the researcher used the Focus Group Recruitment Script (Appendix E) to announce the need for volunteers to participate in the focus group interview the following week.

2. While participants were completing the post-intervention questionnaire, a sign up form was passed around. Volunteers had the opportunity to sign the form.

3. The following week, the researcher met with the volunteers and had them read and sign the Focus Group Interview Consent Letter, which indicated that the interviews would be recorded and filmed for accuracy of transcription.

4. Once the recording devices were on, the researcher started the interview asking each participant to respond to each question.

5. After all questions were asked, the research gave the participants if they had any additional comments.

6. The researcher thanked the volunteers and mentioned that the results of the study would be available to the participants upon completion of the dissertation.

APPENDIX J

TEACHER RESOURCE SITE

iCAT Program

Courses | Discussions | Brad Bostick | Amy Brass | Brian Hoffner | Deb Preach | Pam Roggeman | Andrea Tovar

Resources

Poll Everywhere

Description: Online software that can help engage students; provides immediate feedback and 100% participation; and helps promote discussions.

[Click here to go to PollEverywhere.com]

What can Poll Everywhere do?

~Fully engage participants
~100% responses
~Collect real-time data

How can Poll Everywhere be used?

~Use a MC question to stimulate an essay question
~Opinion question
~Data gathering questions
~Prediction questions
~Feedback on teaching

Podcasts

Description: A podcast is a series of digital media files (either audio or video) that are released episodically and often downloaded through web syndication.

How can Podcasts be used in classroom:

~Classroom updates/newsletters
~Class lectures for absent students
~Review
~Remediation or acceleration
~Author studies
~Learn a new language
~Helpful for ELL learners

[Click here to view 4th graders Podcasting]

Podcatching sites:

[iTunes]
[Podbean]
[Podcastalley]
[Podfeed]

iPads

Description: With iPad, the classroom is always at your fingertips. Right now at the App Store, there are thousands of apps available to download. Students can track their assignments, take notes, and study for finals. Teachers can give lessons, monitor progress, and stay organized. apple.com

[NETS-DVL Videos]

Individual Apps from App Store

**Geometry Classroom (9th grade)*
**STEM: Algebra (9th grade)*
**Science Lessons: Bird Rap (7th grade)*
**Million Dollar Project (4th grade)*
**Inventions Lesson (3rd grade)*
**Awesome Authors (3rd grade)*
**World Wide Weather on the Web (2nd grade)*
**Population Growth (7th grade)*

Teaching with Technology App (includes 22 episodes)

**Using an Online Simulation for Problem Solving (6th grade)*
**Acceleration (11th & 12th grade)*
**Finding Areas of Geometric Shapes using Geoboards (6th grade)*
**What Makes the Writer Write (9th grade)*
**Awesome Authors (3rd grade)*
**Inventions (3rd grade)*
**Creating Equations from Coordinate Pairs and Tables (8th grade)*
**Using Graphing Calculator Temperature Probes in Math (7th grade)*
**Making Connections between Graphs-Tables Equations (6th grade)*
**Into the Next Millennium (6th grade)*
**Developing Mathematical Problem Solving Strategies (6th grade)*
**Using a Handheld Computer Simulation for Problem Solving (6th grade)*
**Lining Up Data (9th grade honors)*
**Logical Journey of the Zommbinis (6th grade)*
**World Wide Weather (4th grade)*
**Getting It Right! An Investigation of the Pythagorean Theorem (7th grade)*
**Worldwide Weather on the Web (2nd grade)*
**Creating a Heroic Character (6th/7th grade honors)*
**Population Growth and Urban Planning (7th grade)*
**Million Dollar Project (4th grade)*
**Solving a Logical Reasoning Problem (6th grade)*
**Investigating Area and Perimeter with Graphing Calculations (9th grade)*

[Click here to view a list of Educational Apps for Students]
[Click here to view a list of Educational Apps for Teachers]

Screencasting

Description: A screencast is a screen capture of the actions on a user's computer screen, typically with accompanying audio. Screencasts provide students with lessons they can watch at their convenience, as often as they choose, to review class material or to help understand concepts they find difficult. Students can stop and start presentations, giving them control over how a lesson unfolds, which can help accommodate different learning styles and speeds. source

[Click here to view several sample screencasts]

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APPENDIX K

SAMPLE INSTRUCTOR TIME LOG

	Type	Date	Description
Session 1	CoP	10/27	Initial meeting to introduce iCAT Discuss possible technologies to be used in class
Session 2	CoP	11/18	Start discussion as to how technologies can be used in each class. Show Google Forms w/iPad. Talk about class log.
Session 3	1-on-1	12/5	Worked together to get JING installed on [instructor]'s computer. Tested it out. Created a screencast for her current class.
Session 4	CoP	12/16	Distribute iPads. Show the various apps that are pre-installed. Show how to open a PDF in iBooks, how to download a free app, how to use Air Display, and how to use Google Forms on the iPad for formative assessment.
Session 5	1-on-1	1/4	Worked on screencasting and how to integrate into classroom. Developed a Google site so that students could contribute ideas for integrating the various iCAT technologies.
Session 6	Skype	1/12	Worked to correct some technical glitches with her Google site. Discussed iPad technical issues and how to resolve the updates
Session 7	1-on-1	1/17	Practiced using the iPad (moving apps, downloading from the Cloud, creating folders) and opening PDFs in iBooks. Discussed how alternative ways of presenting information to the control group.
Session 8	CoP	1/27	Lunch, distribute iPad adapters and cables, discussed things that were going well with each others' classes and talked about ideas for integrating technologies into each of the classes
Session 9	Observation	2/6	Observed [instructor] as she demonstrated various apps to her students. She also gave time for students to interact with their iPads and find Blooms-related apps. She concluded with a Poll Everywhere question. See Evernote

			journal for notes.
Session 10	CoP	3/2	The entire group met because it was the middle of the semester. Two classes had completed, two new classes were starting, and the two 16 week courses were at the mid-way point. The meetings was designed to talk about what went well, anything that could be modified or changes, and to provide hints for the new classes.
Session 11	1-on-1	3/7	Screencast practice. [instructor] created a few screencasts and uploaded to Screencast.com in preparation for her screencast iCAT session after spring break.

APPENDIX L

INSTRUCTOR REFLECTION LOG

Integration Log

Please complete this after each class session.

* Required

Instructor *

Select one

Date of class session *

Live form can be found at
http://tinyurl.com/iCAT-reflection

How did you model/use technology in your Monday
Include what you used and any activities or assignments you had your students do.

How did you model/use technology in your Tuesday evening class today?
Include what you used and any activities or assignments you had your students do.

How did your students use technology in your Monday evening class this week?
Include any technologies they used and how they used them (both in and out of class)

How did your students use technology in your Tuesday evening class this week?
Include any technologies they used and how they used them (both in and out of class)

What would you have done the same (or differently) if you had the opportunity to do it again?
Be sure to identify if you are referring to your Monday or Tuesday evening class here.

Did you notice any differences between the two sections of classes this week? *

Any additional comments you would like to add? *

Submit

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APPENDIX M

INSTRUCTOR REFLECTION LOG REMINDER PROTOCOL

1. The researcher would send the instructors an email (see below) each Wednesday reminding them to complete their reflection log.

2. If the instructor did not complete the reflection log by Saturday, the same email would be resent to remind them to complete the reflection log.

Hi all, This is just a friendly reminder asking you to complete the reflection log for this week's classes. If you did not have class for one of your sections then simply put "n.a." in the text box. Your feedback/reflection will provide extremely important data to help determine the effectiveness of the intervention. http://tinyurl.com/inmaclog Please complete the form even if the only technology used was your laptop and the projector or classroom computer and projector. I'll send out a reminder next week so that you do not have to keep track. Thank you again for taking the time to complete this reflection form. Todd

APPENDIX N

IRB APPROVAL LETTER

ARIZONA STATE UNIVERSITY
Knowledge Enterprise Development

Office of Research Integrity and Assurance

To: Keith Wetzel FAB

From: Mark Roosa, Chair Soc Beh IRB

Date: 12/05/2011

Committee Action: Exemption Granted

IRB Action Date: 12/05/2011

IRB Protocol #: 1111007148

Study Title: Comparing Graduate courses taught by the Same Instructor Using Competing Approaches

The above-referenced protocol is considered exempt after review by the Institutional Review Board pursuant to Federal regulations, 45 CFR Part 46.101(b)(1) .

This part of the federal regulations requires that the information be recorded by investigators in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects. It is necessary that the information obtained not be such that if disclosed outside the research, it could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

You should retain a copy of this letter for your records.